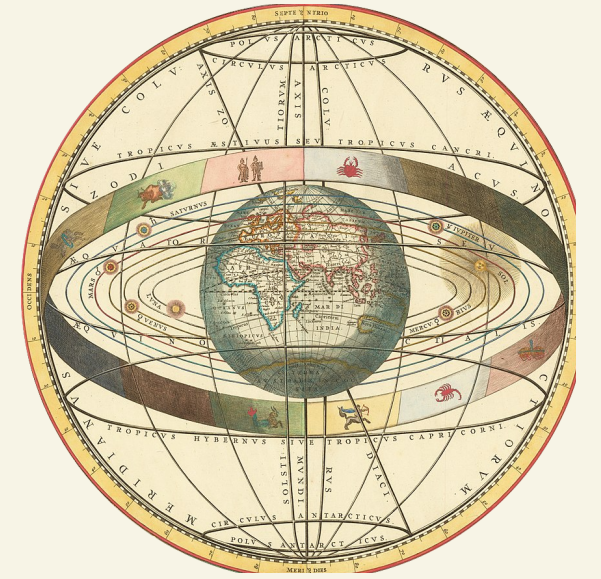
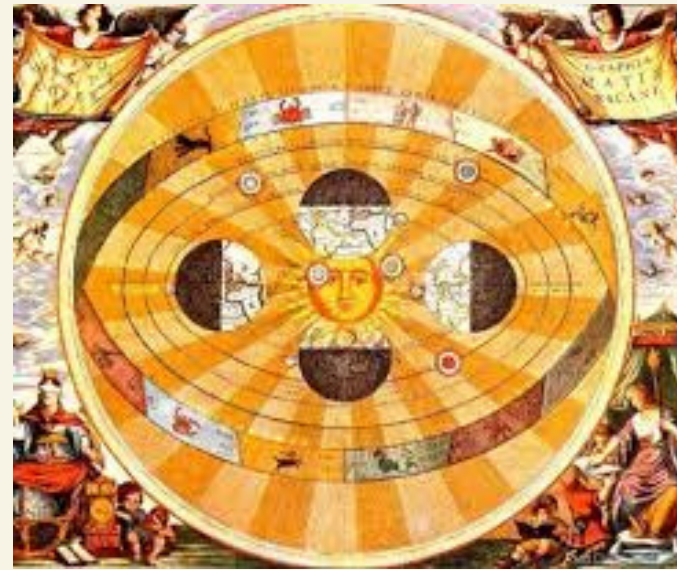
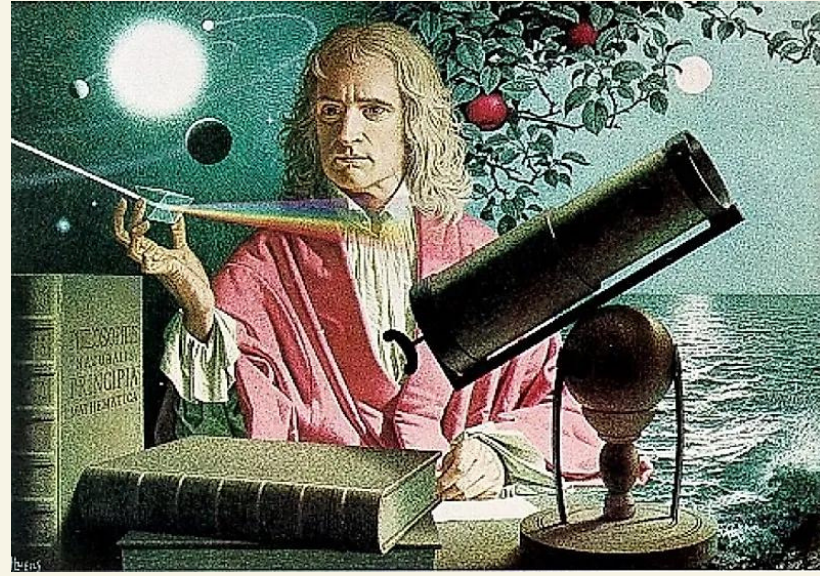
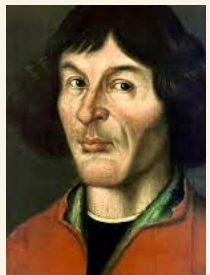


# The Scientific Revolution

Jake Choi, Harry Jun



## Who



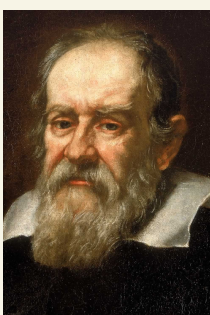
**Nicolaus Copernicus (1473~1543):** Copernicus claimed that the planets, including earth, revolved around the sun following a certain orbit. This challenged the original theory, geocentric theory. Since the Bible mentioned that the earth was made by God at the center of the universe, Copernicus expected that his theory would be rejected by most scholars and clergy, leading him to publish his work as a book on his deathbed (Westman).



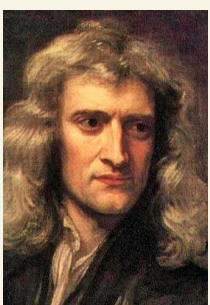
**Rene Descartes (1596~1650):** He worked on mechanics which was the basis of his physiology and medicine. His accomplishments had a great impact on mathematics that is studied today, especially in algebra and geometry (Westman).



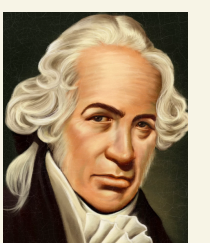
**Johannes Kepler (1571~1630):** He was the assistant of Tycho Brahe, a Danish astronomer who recorded the movements of planets for many years. Kepler published a book called Epitome of Copernican Astronomy, which was a book that gathered all the arguments of Copernicus's theory (Westman).



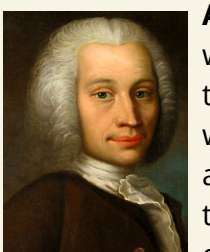
**Galileo Galilei (1564~1642):** In 1609, Galileo made the first effective use of the refracting telescope he made to discover new important facts in astronomy. His first discovery was that the moon is not perfectly smooth, as Aristotle and Ptolemy claimed. Furthermore, Galileo notices that Copernicus's heliocentric theory was correct. After a few conflicts with the church, Galileo was forced to read aloud a signed confession in front of the cardinals. Until his death, Galileo lived under house arrest (Helden).



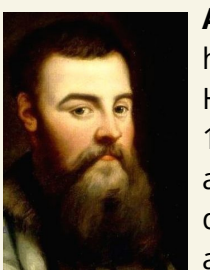
**Issac Newton (1642~1727):** He made a lot of contributions to the fields of physics and mathematics. He found out that the same force ruled the motion of an object on earth to the motion of planets. His work provided the basis for modern physics and mathematics, which is still learned in high school courses today (Westfall).



**Gabriel Fahrenheit (1686~1736):** Gabriel Fahrenheit was a German physicist who invented the mercury thermometer. His thermometer was more accurate than the alcohol-and-water thermometers that were used previously by many European scientists. His creation of the thermometer led to the development of the Fahrenheit temperature scale. On this scale, pure water froze at 32° and boiled at 212°.



**Anders Celsius (1701-1744):** Anders Celsius was a German physicist who developed the Celsius scale. This is the scale used to measure temperature in the metric system. In 1742, Celsius developed a new way of marking thermometers. He set the freezing point of pure water at 0° and the boiling point at 100°. Other than creating the new temperature scale, he was also the first person to link auroras to disturbances in Earth's magnetic field.



**Andreas Vesalius (1514~1564):** He is often called the founder of human anatomy. He published a book called *On the Structure of the Human Body* in 1543 which provided a clear and detailed illustration of human anatomy. He dissected human bodies and gained knowledge that disproved previous theories of human anatomy. He is an important anatomist who provided the basis of modern anatomy.



**Robert Boyle (1627-1691):** Robert Boyle was a philosopher and theological writer who was famous in the field of chemistry. In the book he wrote, Boyle challenged Aristotle's ideas that the physical world is an assembly of four elements which are earth, air, fire, and water. His law formed a basic knowledge of modern science of how volume, temperature, and pressure of gas affect each other (Principe).

## When

The Scientific Revolution (1543-1687) was a set of events that occurred during the early modern period that signaled the formation of modern science, when advances in mathematics, physics, astronomy, biology, human anatomy, and chemistry altered society's understanding of nature. The rise of Humanism during the Renaissance triggered the interest of many scientists and thinkers to roll into the Scientific Revolution. All of these factors combined in the early 1500s to bring to the Scientific Revolution, interest in ancient Greek texts, the rise of humanism, and alchemists' experiments. Also, the changes in society such as Reformation made many scholars to doubt what they believed until then. As a result, the Scientific Revolution occurred after Reformation in 1521. For example, many of the important scientific inventions or discoveries, such as the proposal of Heliocentric theory and the discovery of gravity that happened in 1543 and 1687 respectively, which was after the Reformation. Therefore, the Scientific Revolution typically occurred during the 16th to 17th century due to these reasons.

## What

### A new way of thinking

Beginning in the mid-1500s, a few scholars published works that challenged the ideas of ancient thinkers and the teachings of the Catholic Church. As the Roman Catholic church relatively lost its authority during the Middle Ages, it created a cultural change called the Renaissance, leading scholars to launch a new change in Europe called the Scientific Revolution. The Scientific Revolution drastically changed the scientific thought process. Scholars provided evidence about their claims using the records of their careful observations or calculations. Also, they continuously questioned accepted beliefs that did not have clear evidence and suggested new theories. As a result, a new way of thinking led scholars and scientists to launch a drastic change in European society, called the Scientific Revolution. (P.623)

### The Heliocentric Theory and the Conflict with the Catholic Church

The geocentric theory is a theory that states that the earth is the center of the universe, which means suns, solar planets are all orbiting around the earth. On the other hand, Heliocentric theory states that all solar objects such as Earth, moon, and stars orbit around the sun. The Heliocentric theory was proposed by Nicolaus Copernicus Galileo was a scientist who had further studies and discoveries about the solar relationships between sun earth and other planets. Galileo's further discovery of the theory of Heliocentric and published a book called Starry Messenger, which explains the observations he got. During the 1600s, Catholic Church supported Geocentric theory since earth as the center of the universe made earth special and powerful. Galileo's discoveries frightened both Catholic Church and Protestants since the statement was against their idea. To prevent the further spreading of the Heliocentric theory, Catholic Church wanted Galileo to stop his studies. By force in 1633, Galileo confessed that the idea of Copernicus was wrong. Until his death, he was never treated as a free man until he died since he lived under house arrest for the rest of his life. (P.625)

### Scientific Method

Copernicus, Kepler and Galileo developed a new approach of thinking which is scientific method. This method includes a logical procedure during the testing, questioning the problems of the cause and making personal hypothesis was the main goal of scientific method. Scientific method was further developed by a Bacon and Descartes which led a better understanding of general laws in science during the scientific revolution era. (P.625)

### Newton's law of gravity

Isaac Newton was a scientist who brought the theory of motion, the idea of gravity. One of his greatest discoveries is that the same force ruled the motion of the planets and all matter on earth and in space. This explains that every object attracts the other. In 1687, he published a book of "The Mathematical Principles of Natural Philosophy" which impacted and led to the development of modern science. (P.626)

### The Scientific Revolution Spreads

Scientists began to develop a study a secrets of nature on earth. The careful observation, which is one of the features of scientific revolution eventually led the importance of spreading in many different fields. Precise observations of bacteria and atmospheric pressure and predicting the weather by using a scientific instrument led a further development of scientific spreads. Furthermore, publishing books about each subjects, led middle class people to have better understanding of scientific revolution and helped a further spread of scientific revolution (P.627)

## Where

Even though Europe was not the most intelligent and powerful group of nations, they were the first to develop Scientific Revolution. It is because many Europeans at that time began to develop a new way of thinking and question the things that ancient thinkers and the Church stated in a vague way.

On the other hand, China had difficulty because Chinese education system were focused on preparing males for the civil service examinations rather than freedom of studies. Chinese government didn't allow independent institutions of learning where scholars could pursue their studies freely and develop on their potential subjects.

Furthermore, Islamic world also had difficulty of development of Scientific Revolution because they focused on the Quran which is the studies of religious law in Islam. Because Islamic world focused on religion rather than studying other subjects, the statement against religion was belief were seen a strange.

Therefore, it was very natural that the Scientific Revolution happened first in Europe rather than any other continent or cultural region in the world. This eventually led to the Industrial Revolution later on and led to the colonization to occur by European countries.

## Why

The Scientific Revolution got its own section because it developed scientific methods that are still used today by getting away from ancient ideas through a new way of thinking. As the church authority declined during the Middle Ages due to the effect of the Reformation, many Europeans started to rethink the concepts or principles of nature that ancient thinkers and the Catholic Church claimed. During the 16th and 17th centuries, many scholars challenged the theories that were originally believed to be correct. Nicolaus Copernicus challenged the geocentric theory, which considered that Earth was the center of the universe, by claiming the heliocentric theory, which stated that the sun was at the center and the Earth and other planets revolved around it (pg 190). Furthermore, Issac Newton, an English mathematician, physicist, and astronomer, provided a new explanation about the concepts of force and planetary paths employing it by interacting with another scholar named Robert Hooke (Spencer). The reason why a new way of thinking and new scientific methods developed during the Scientific Revolution was because people's thoughts about society began to change. Due to the Reformation and the Renaissance, Europeans experienced changes in their beliefs, cultures, and theories that they believed were absolutely true. As a result, Europeans naturally questioned the vague theories of ancient thinkers and the church that they were taught for hundreds of years. Therefore, a new way of thinking and the scientific methods to prove the theories or claims of scholars developed and advanced, creating a large change in the European society called the Scientific Revolution. It eventually led the Europeans to advance their understanding of nature and technology and create a basis for the Industrial Revolution later on.



<Map of Europe during the Scientific Revolution>