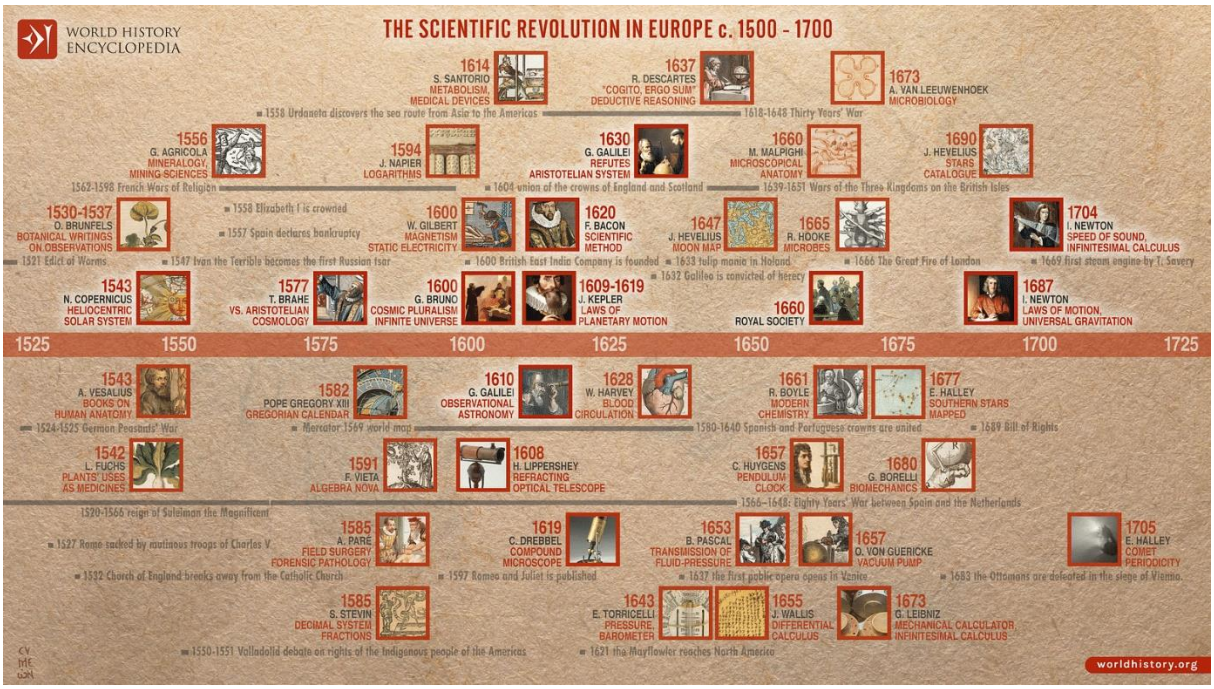
Democratic and popular republic of Algeria
Ministry of Higher Education and Scientific Research
Abderrahmane Mira –Bejaïa- University

Course : Universal History Of Biological Sciences

Chapter IV : Renaissance and Scientific Advancements (16th and 17th centuries)



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Introduction

The 16th and 17th centuries marked a transformative period in the history of science, laying the groundwork for modern scientific thought. During the Renaissance and the Scientific Revolution, new discoveries across various fields—such as biology, medicine, physics, and astronomy—challenged traditional views and promoted a more empirical approach to understanding the natural world. Visionary scientists like Vesalius, Harvey, and Newton reshaped their respective fields, and their work continues to influence science today. This period was crucial in the development of the scientific method, which remains central to research and technological progress.

Figure 1 : The School of Athens" by Raphael, symbolizing the fusion of ancient and modern knowledge.

I. Renaissance and Scientific Advancements in the 16th Century

Historical Context

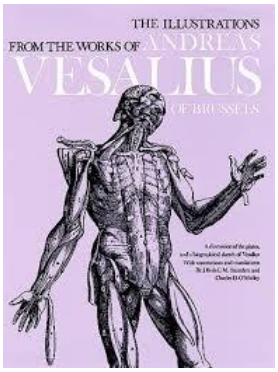
The 16th century marks a significant break from the Middle Ages. This period, known as the Renaissance, is characterized by a renewed interest in ancient knowledge, a questioning of religious dogmas, and the emergence of a scientific method based on observation and experimentation.

I.1. Key Features of the Renaissance

- **Rediscovery of Ancient Knowledge**
  The works of philosophers and scholars like Aristotle, Galen, and Pliny the Elder are studied and enriched.
- **Development of the Scientific Method**
  Based on observation, it replaces dogmatic beliefs.
- **Technological Advancements**
  The invention of the printing press by Gutenberg allows for the widespread dissemination of knowledge.
- **Renaissance in Art and Science**
  The intersection of arts and sciences leads to major innovations.

Figure 2 : Map of Europe in the Renaissance

I.2. Revolutionary Scientists of the 16th Century



1. Andreas Vesalius (1514-1564)

- **Field : Medicine and Biology**

Vesalius is one of the pioneers of modern anatomy. In his treatise *De Humani Corporis Fabrica* (1543), he corrects Galen's errors by relying on human dissections. His precise descriptions of the human body lay the

foundations of modern anatomy.

2. Leonardo da Vinci (1452-1519)

- **Field: Art and Biology**

As an artist and scientist, Leonardo conducted clandestine dissections and meticulously drew muscles, bones, and organs. His works reflect his detailed observation and quest for perfection.

Figure 3 :* Vitruvian Man *and anatomical drawings of fetuses.

3. Ambroise Paré (1510-1590)

- **Field: Medicine and Surgery**

The father of modern surgery, Paré replaces cauterization with the ligation of arteries during amputations. He also invents prosthetics and improves wound treatment techniques.

4. William Turner (1508–1568)

- **Field: Botany**

Known as the "father of English botany," Turner's *Herbal* documented the medicinal properties of plants.

5. Girolamo Fracastoro (1478–1553)

- **Field: Microbiology**

Fracastoro proposed the germ theory of disease, suggesting that "seeds" spread illnesses.

Figure 4 : A visualization of Fracastoro's contagion theory.

6. Nicolaus Copernicus (1473-1543)

- **Field: Astronomy**

Copernicus revolutionizes cosmology by establishing the heliocentric theory, which posits that the Earth orbits the Sun. Although an astronomer, his work influences the scientific method in general.

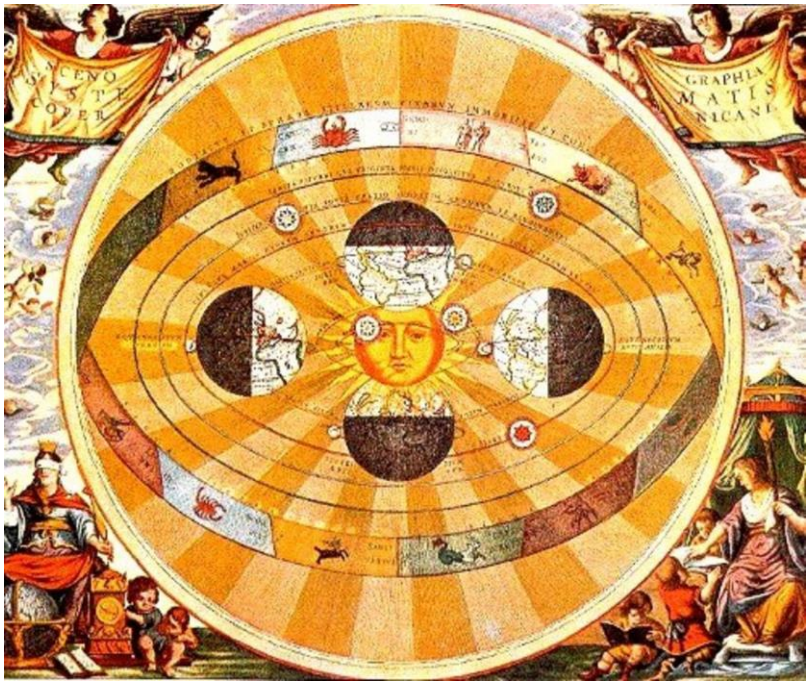


Figure 5 : Representation of Copernicus' heliocentric system.

II. Scientific Advancements in the 17th Century

Transition to the 17th Century

The 17th century is considered the era of the **Scientific Revolution**. Scientists develop tools like the microscope and adopt a rigorous experimental method. Scientific academies (the Royal Society in 1660, the French Academy of Sciences in 1666) structure research.

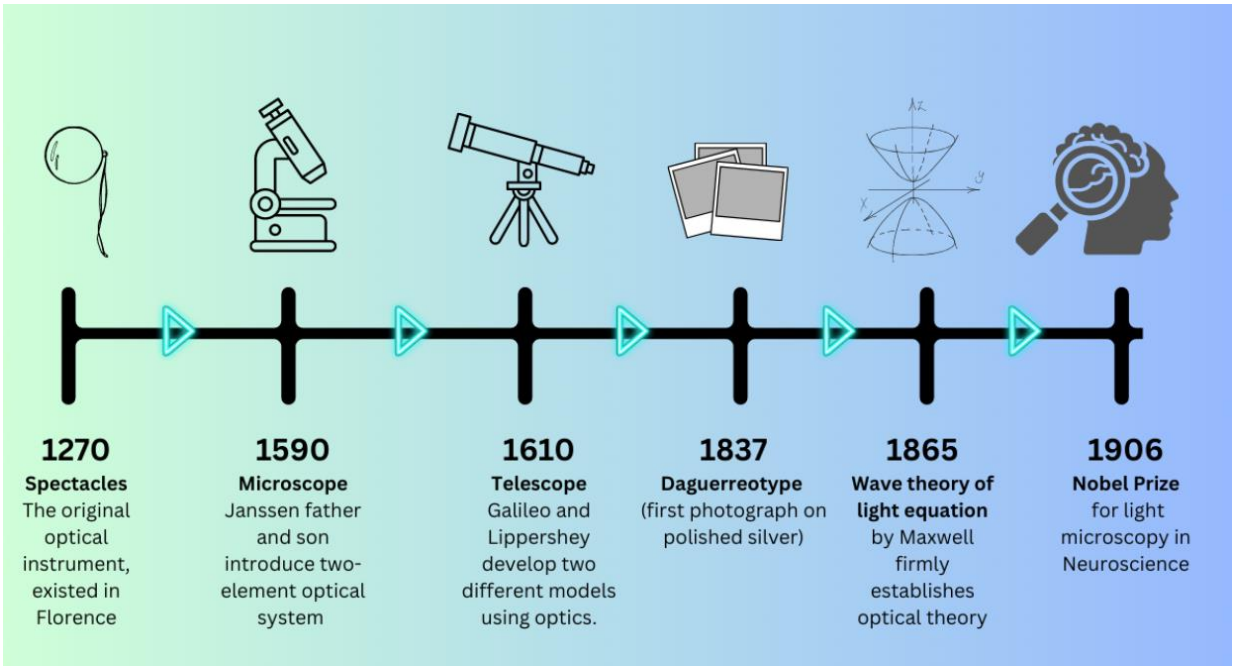


Figure 6 : Evolution of scientific tools (telescope, microscope…)

II.1. Key Scientists and Major Discoveries of the 17th Century

1. **William Harvey (1578-1657)**

- **Field: Medicine and Physiology**

Harvey discovers the circulation of blood and proves that the heart acts as a pump to circulate blood throughout the body. He disproves Galen's ideas and offers a revolutionary description in *De Motu Cordis* (1628).

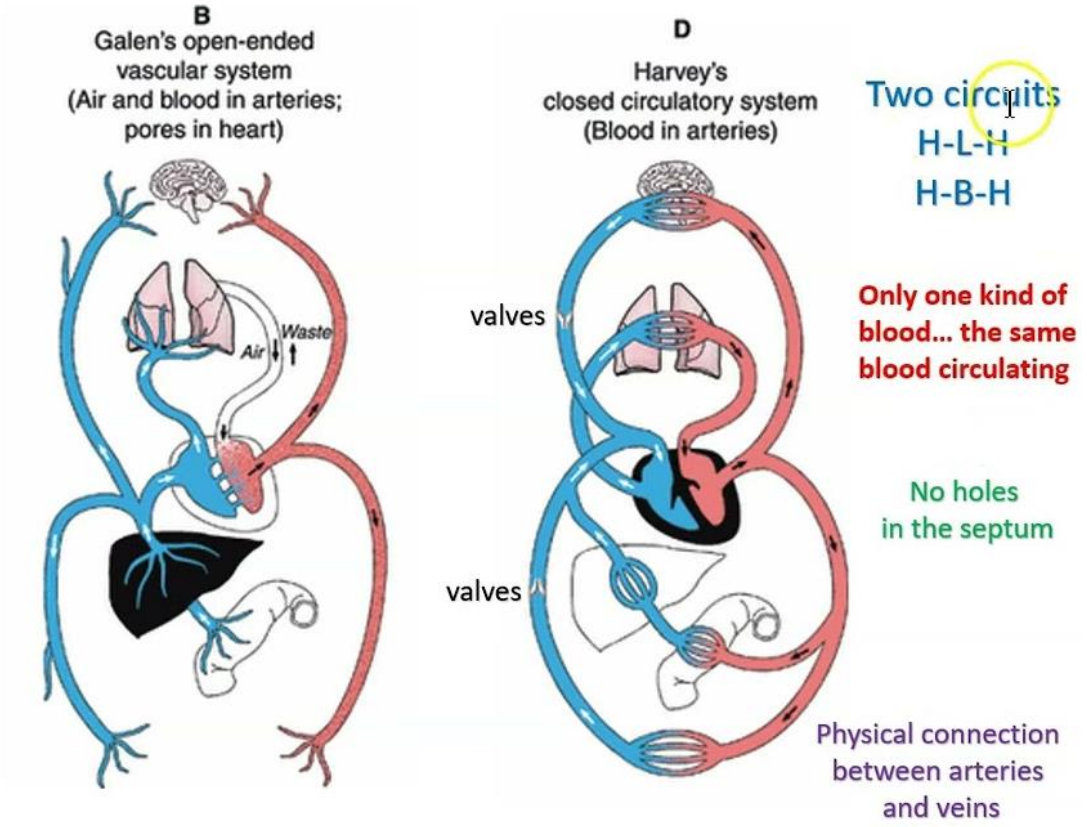


Figure 7 : The circulatory cycle described by Harvey.

2. **Francisco Redi (1626-1697)**

- **Field: Biology and Experimentation**

Redi disproves the theory of spontaneous generation by showing that flies come from eggs laid by other flies.

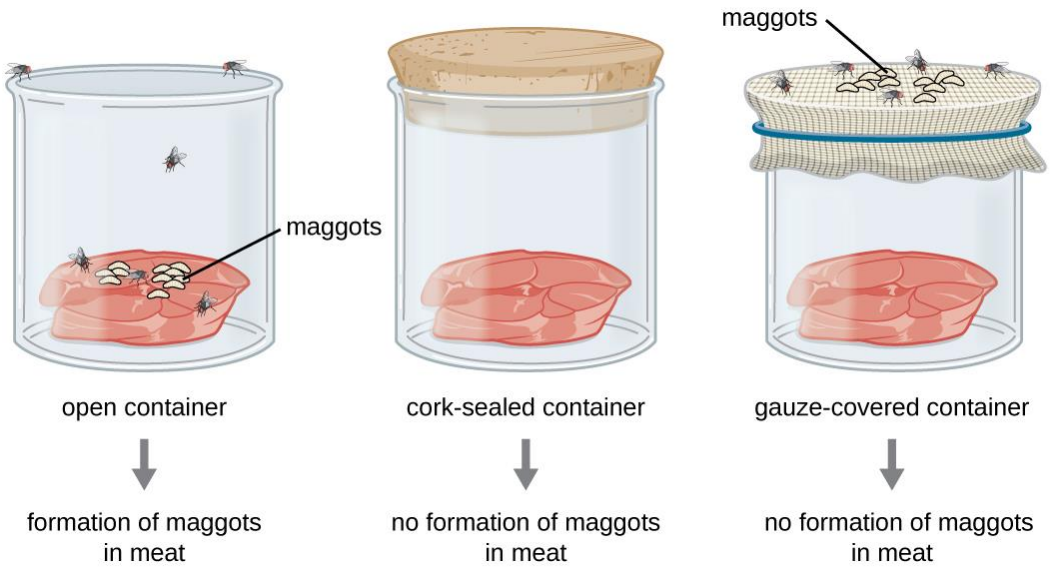


Figure 8 : Redi's experiment on spontaneous generation.

3. **Robert Hooke (1635-1703)**

- **Field: Biology, Engineering, and Physics**

Hooke publishes *Micrographia* (1665), where he describes cells for the first time by observing a slice of cork. He introduces the term "cell."

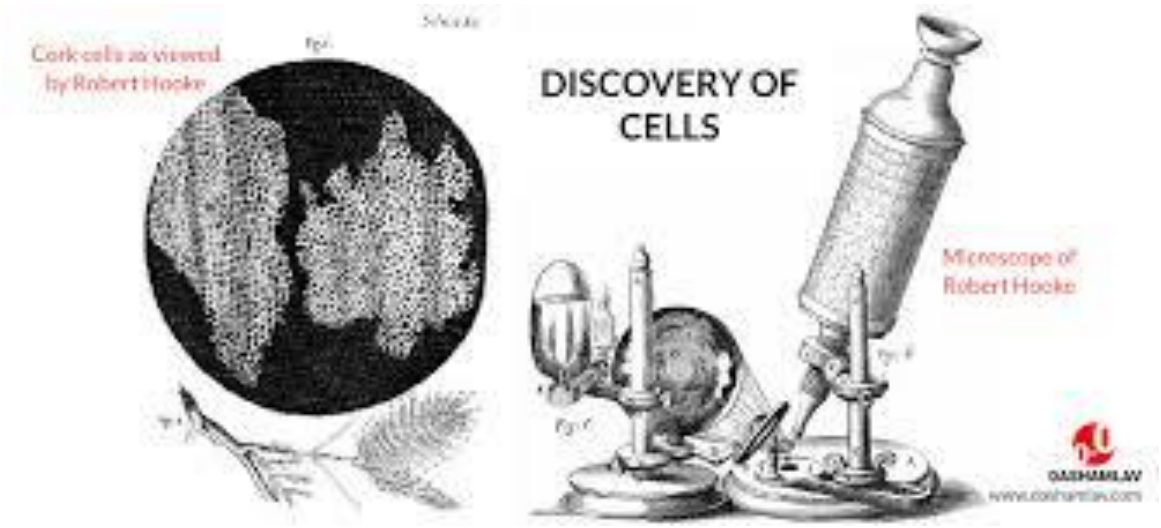


Figure 9 : Drawings of cells observed by Hooke.

4. **Antoni van Leeuwenhoek (1632-1723)**

- **Field: Microbiology and Engineering**

With his enhanced microscope, Leeuwenhoek is the first to observe bacteria, protozoa, and sperm cells, opening the path to microbiology.

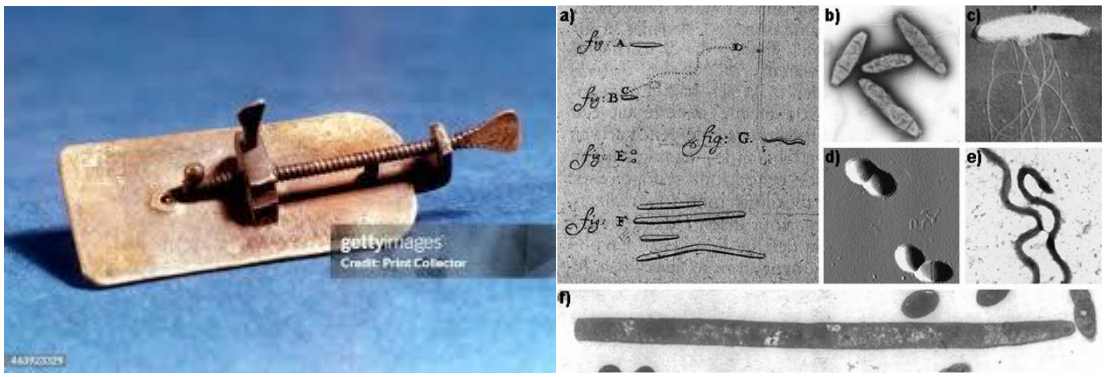


Figure 10 : Leeuwenhoek's microscope and drawings of microorganisms.

5. **Marcello Malpighi (1628–1694)**

- **Field: Histology**

Malpighi described capillaries and the microscopic anatomy of organs, bridging anatomy and physiology.

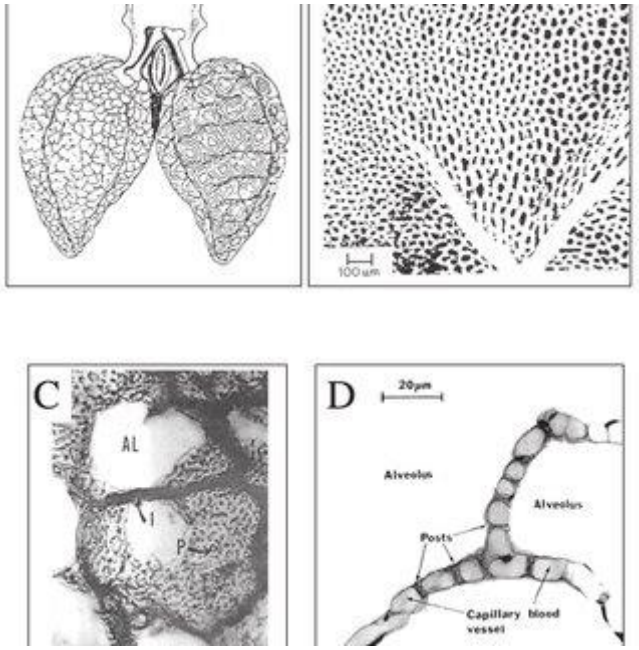


Figure 11 : Capillary networks drawn by Malpighi.

6. **Isaac Newton (1643-1727)**

- **Field:** Physics and Mathematics

Newton, one of the greatest scientific minds, contributes to many fields, including:

- **Universal gravitation**, which influences biology by explaining certain natural phenomena.
- Development of **mathematics** (calculus), which helps model complex biological processes.

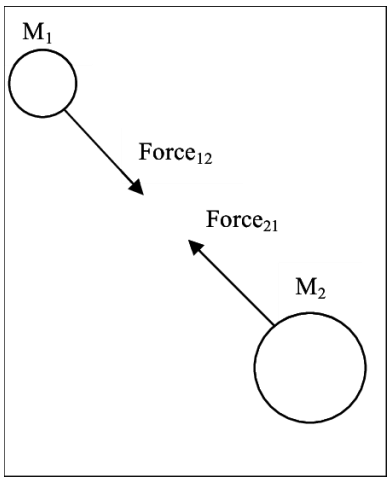


Figure 11 : Newton's laws of gravitation.

7. **Galileo Galilei (1564–1642)**

- **Field: Astronomy and Physics**

Galileo developed the telescope and contributed to the study of motion and celestial bodies.

Figure 12 : Galileo's observations of celestial objects

III. Fundamental Revisions in Biology and Medicine During the Renaissance

The Renaissance brought about the correction of several misunderstood or incomplete concepts in biology and medicine inherited from ancient works. These major revisions transformed our understanding of the human body and vital processes.

1. **Blood Circulation**

Galen believed that venous and arterial blood circulated in separate systems.

- **Ibn Al-Nafis** (13th century) described pulmonary circulation, demonstrating that blood passes through the lungs to be oxygenated. However, his theory remained largely unknown in Europe for centuries.
- **William Harvey** (17th century) completed this understanding by proving that blood circulates in a closed system, propelled by the heart.

2. **Spontaneous Generation**

The idea that living beings could arise spontaneously from inanimate matter was widely accepted.

- **Francisco Redi** (1668) disproved this theory by showing that flies originate from eggs laid by other flies, sparking critical scientific inquiry.

3. **Human Anatomy**

Galen's anatomical descriptions, based on animal dissections, contained inaccuracies.

- **Andreas Vesalius** (1543), through human dissections, corrected these errors in his work *De Humani Corporis Fabrica*, laying the foundation for modern anatomy.

These revisions marked a pivotal step in the history of science, driven by rigorous observation and the adoption of the experimental method.

Conclusion

The scientists of the 16th and 17th centuries revolutionized science through rigorous observation and challenging established ideas. Their work in biology, medicine, physics, and astronomy laid the foundations for modern science.

Figure 13 : Chronology showing the transition from the Middle Ages to the modern era.