CHAPTER 17

The Scientific Revolution and the Enlightenment, 1550–1790

CHAPTER OUTLINE
I. A Revolution in Astronomy
   A. Ancient and Medieval Astronomy
      1. Europeans synthesized the ideas of the ancient philosopher Aristotle and the
         astronomer Ptolemy with medieval Christian theology to form a worldview where
         earth was at the center in the worst, lowest position, while the planets and other
         heavenly bodies spun above in the harmony of the spheres, closer to their God’s
         heaven.
      2. This picture of the natural world was confirmed by common sense, was reinforced by
         predictions, and corresponded with the revealed truths of Christian scripture.
   B. A New View of the Universe
      1. A new view of the universe challenged the traditional one, deepening an intellectual
         crisis fed by the Protestant Reformation, Wars of Religion, and discovery of the
         Americas.
      2. Nicholas Copernicus argued that the earth and the planets moved about the sun (1543).
      3. Tycho Brahe argued that the planets moved around the sun, but the sun still moved
         around the earth.
      4. Johannes Kepler argued that the planets moved in elliptical, not circular, orbits at
         variable speeds.
      5. Galileo Galilei used the telescope to see craters and describe sunspots, all
         imperfections at variance with theological authorities, so the Roman Inquisition placed
         him under house arrest.
      6. Sir Isaac Newton, in his Mathematical Principles of Natural Philosophy (1687), used
         mathematics and a theory of gravity to create a compelling all-encompassing
         description of the universe and the modern science of physics.
   C. Models of Scientific Knowledge
      1. Sir Francis Bacon advocated knowledge grounded in observation and experimentation
         and was an early defender of the inductive method of reasoning.
      2. René Descartes used self-examination to form the deductive method, based on
         geometry and human reason.
      3. Newton combined the inductive and deductive methods, laying the foundation for the
         modern scientific method.
   D. Why Change Occurred
      1. Many factors contributed to the new view of the universe.
         a) Renaissance humanists rediscovered ancient authors, which made it clear that
            theories could be challenged.
         b) Mathematics was applied to solve specific problems, which was in tune with the
            humanist emphasis on useful knowledge.
         c) Thinkers such as Galileo used craft traditions of experimentation to examine
            natural phenomena more precisely.
d) Alchemists believed that nature contained hidden powers, which could be revealed through observation and experimentation.

e) The study of anatomy also received increased attention when Andreas Vesalius proved that the ancient doctor Galen was incorrect and William Harvey developed a new theory of blood circulation in 1628.

II. The Impact of the New Science

A. Scientific Networks

1. Scientific networks developed in princely courts, but later they generally worked free of direct royal control in chartered associations, such as the Royal Society of London and the French Royal Academy of Sciences.

2. These groups of mostly males demonstrated experiments, published reports, followed orderly procedures and polite behavior, and cultivated a scientific objectivity free of personal ambition, prejudice, and passion.

B. Science and Religion

1. There was no inherent conflict between science and religion; practitioners of the new scientific method such as Descartes and Newton thought of it as a way to pursue their religion more faithfully.

   a) The argument from design reinforced the idea that if a clock required a clockmaker, the universe required a universe maker.

   b) Descartes said that God endowed human minds with the ability to reason and that God gave humans the innate idea of him as an infinite being.

2. The devout Jansenist and mathematician Blaise Pascal supported the “heart” as another source of knowledge, in addition to reason and observation.

C. Science and the State

1. Some applied the new ideas about science to the state.

2. In an obsequious sermon to Louis XIV, Jacques-Bénigne Bossuet preached that as the planets orbited around the sun, so French subjects should be obedient to the Sun King.

3. Thomas Hobbes argued in *Leviathan* (1651) that all life was “nasty, brutish, and short,” so the solution was to submit to an ironclad authority to protect us from ourselves.

   a) He argued that absolutism was based on a contract between ruler and ruled, not on God’s will.

4. John Locke had a more optimistic view of human nature than Hobbes did, arguing that government represented a voluntarily political contract with the purpose of protecting private property (such as slaves).

D. The Nature of History

1. The New Science provoked arguments about the nature of human history.

2. Traditional views of history, held by the ancients, saw it as a decline from an original high point, identified as the Garden of Eden or Greek and Roman culture. Others presented history in cyclical terms, with cycles of high points and declines.

3. A new view of history, held by Moderns, optimistically argued that human history was a story of intellectual progress.

III. The Enlightenment

A. The Early Enlightenment

1. In England, John Locke argued that minds at birth are blank and all ideas arise only through experience, which repudiated the idea of innate ideas and limited knowledge to sense impressions.

2. In France, the Baron de Montesquieu focused on human beings as a group, positing that climate and geography accounted for variations in a universal human nature—an early approach to the modern discipline of sociology.

B. Voltaire
1. The celebrated French philosopher and author Voltaire learned to admire the English system of government while in exile there.
2. He sought to reform the criminal justice system, arguing against the use of torture, and turning the Calas affair into a European scandal.
3. He attacked traditional Christianity in part because, as a student, he was sexually molested by Jesuits.
4. In *Candide*, he attacked the optimism of Leibnitz and endorsed a limited optimism.

**C. Enlightenment Religion**
1. Voltaire was not an atheist, but rather embraced Deism, a rational religion based on the observation of nature.
2. Deism denied the Christian doctrines of the Trinity, the divinity of Jesus, and the divine authority of the Bible, and the idea that God intervenes in the universe.
3. Deists, including Voltaire, Benjamin Franklin, and Thomas Jefferson, believed that deism and religious toleration went hand in hand.
4. In addition to battling Christians, Voltaire denounced atheists, but by the mid-eighteenth century, many philosophers believed that the existence of God could never be proved.
5. Moses Mendelssohn argued for Judaism stripped of miracles and supernatural phenomena, believing its basic truths could be proved by reason.

**D. Diderot and the *Encyclopédie***
1. Denis Diderot was the editor for the seventeen volumes of the *Encyclopédie*, a twenty-one-year project to present current knowledge on all subjects and show that knowledge was based on observation, experiment, and autonomous reason.
2. He included articles from major Enlightenment writers; standard articles on religious, philosophical, scientific, and artistic subjects; and contributions on craft and manufacturing processes to ensure its usefulness.

**E. The Late Enlightenment**
1. In the late Enlightenment, Jean-Jacques Rousseau attacked the refined world of the *philosophes*, arguing that human beings were good by nature but that civilization had corrupted them.
2. Rousseau wanted all members of society to voluntarily give up their individual rights and submit to the "general will" to create an open, participatory community that acted for the good of everyone.

**IV. Society and the Enlightenment**

**A. The New World of Reading**
1. Reading habits changed in the eighteenth century from devout, repetitive reading to reading the latest best-selling novel—for example, Rousseau’s *Emile* (1762)—only once, then turning to something else.
2. In addition to novels, newspapers and political pamphlets became available, and people read for worldly information and pleasure.
3. Lending libraries spread, writers were able to make a living from writing, and publishers specialized in certain types of literature, all possible because Europe entered a new period of prosperity.

**B. Enlightenment Sociability**
1. Coffee and tea houses were places where men of different backgrounds could discuss politics and current events politely.
2. Salons became a central Enlightenment institution for the educated and well-born. They were run by hostesses who assigned scientific, artistic, and political matters for discussion by men and women, nobles and commoners.
3. Masonic lodges offered a new form of social interaction for masons where brotherhood in the lodge made all members equal, regardless of social and economic differences.
C. The Enlightenment and Politics
1. In Scandinavia, Germany, and Russia, Enlightenment rationalism melded with cameralism, which aimed at increasing a state’s wealth through direct management of the people and resources and emphasized the need to rationally assess the state’s strengths, weaknesses, and needs.
2. In western Europe, greater discussion of politics by ordinary people led to increased popular participation in politics.
3. In England and France, public opinion played a growing role in politics.

V. Enlightenment Debates
A. Europeans and Non-Europeans
1. One set of debates focused on Europeans and non-Europeans in the Americas and the South Pacific.
2. Benjamin Franklin and Thomas Jefferson refuted Abbé Raynal’s view that the Americas were an inhospitable place of degeneration.
3. Diderot used the travel accounts of James Cook and Louis-Antoine de Bougainville to the South Pacific to attack traditional Christian sexual morality as cruel and unnatural when compared to the Tahitians’ freedom.

B. Slavery
1. As demand for slave-produced commodities rose, the slave trade rose, justified by traditional arguments about biblical passages accepting the practice and the subhuman nature of Africans.
2. The philosophers’ attitudes toward slavery were mixed; Hobbes and Locke endorsed it, Voltaire reluctantly accepted it, and Montesquieu argued against it.
3. Several Protestant groups, such as the Quakers, called for its abolition, and some Anglicans condemned the slave trade.
4. Over the course of the eighteenth century, the balance tipped toward the antislavery position.
5. Novelists, poets, and playwrights played a crucial role, such as Aphra Behn’s novel Oroonoko (1688).

C. Men and Women
1. Women’s new social, intellectual, and professional activities raised the issue of similarity and difference between men and women.
2. Descartes, Locke, and Voltaire argued that men and women possessed a common human nature and were intellectual equals.
3. Acceptance of intellectual equality did not prevent philosophes from assigning separate social roles to men and women.
4. Rousseau and physician Pierre Roussel used biology and psychology rather than religious teachings to enforce sexist differences, a position that Mary Wollstonecraft refuted.