

Annual Editions

WORLD HISTORY

VOLUME II

1500 to the Present



Third Edition

WORLD HISTORY VOLUME II

1500 to the Present

Editor

David McComb
Colorado State University

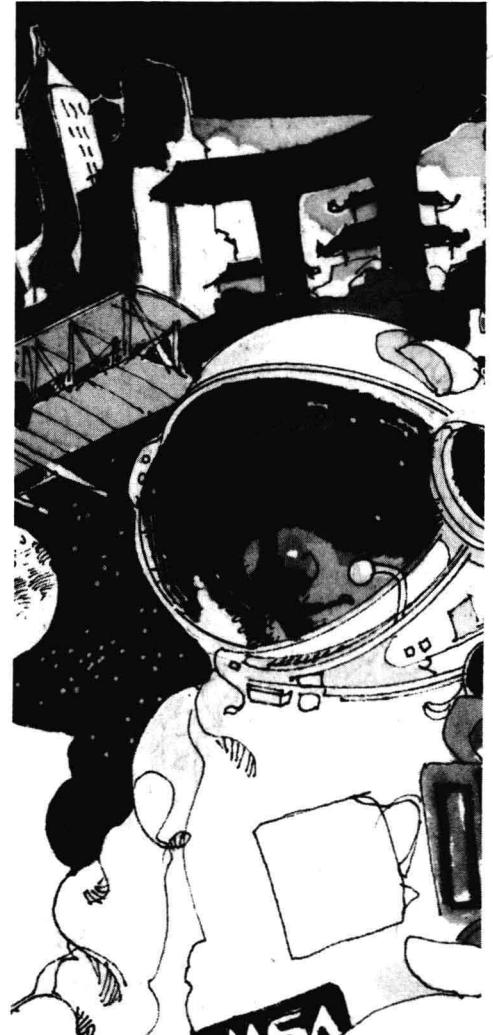
David McComb received his Ph.D. from the University of Texas at Austin and is currently a professor of history at Colorado State University. He has written seven books, numerous articles and book reviews, and he teaches courses in the history of technology, sport, and the world. He has traveled twice around the world as a Semester at Sea faculty member of the University of Pittsburgh, and he spent additional time in India and Mexico.

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Third Edition

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EDITOR

David McComb
Colorado State University

Members of the Advisory Board are instrumental in the final selection of articles for each edition of Annual Editions. Their review of articles for content, level, currentness, and appropriateness provides critical direction to the editor and staff. We think you'll find their careful consideration well reflected in this volume.

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To the Reader

In publishing ANNUAL EDITIONS we recognize the enormous role played by the magazines, newspapers, and journals of the *public press* in providing current, first-rate educational information in a broad spectrum of interest areas. Within the articles, the best scientists, practitioners, researchers, and commentators draw issues into new perspective as accepted theories and viewpoints are called into account by new events, recent discoveries change old facts, and fresh debate breaks out over important controversies.

Many of the articles resulting from this enormous editorial effort are appropriate for students, researchers, and professionals seeking accurate, current material to help bridge the gap between principles and theories and the real world. These articles, however, become more useful for study when those of lasting value are carefully collected, organized, indexed, and reproduced in a low-cost format, which provides easy and permanent access when the material is needed. That is the role played by *Annual Editions*.

Under the direction of each volume's Editor, who is an expert in the subject area, and with the guidance of an *Advisory Board*, we seek each year to provide in each ANNUAL EDITION a current, well-balanced, carefully selected collection of the best of the public press for your study and enjoyment. We think you'll find this volume useful, and we hope you'll take a moment to let us know what you think.

After 1500 the world was increasingly affected by the power and problems of the West. Europe and its offspring in North America experienced a unique transformation during the industrial and scientific revolutions. Western technology allowed a global extension of Western culture. Ideas, not only about science and technology, but also about capitalism, socialism, Christianity, democracy, nationalism, and human rights traveled on the caravels and steamboats. It was a European who dispelled the myth of the "sea of pithy darkness" on the west coast of Africa where sea dragons supposedly ate sailors. It was also a European who discovered the New World, and carried trade to the distant Orient. It was not a Chinese mariner who sailed up the Hudson River, nor an African who forced open the Japanese ports at gunpoint. It was not an Indian who transferred potatoes to Ireland and corn to France. For all of their faults, it was the Europeans, and later the Americans, who ventured forth around the globe and on to the surface of the moon.

The history of the world in the modern period, therefore, intimately concerns the circumstances of the West and the ambitions of its people. As shown in world history texts, Westerners reached into the rest of the world and the indigenous peoples reacted in one way or the other. First, there was colonialism and the carving out of overseas empires. Early conquerors in the Americas and the Pacific used swords, horses, disease, and gunpowder. Later invaders in Africa, China, and India used railroads, telegraphs, quinine, steamboats, and superior guns. Then, after the disasters of two world wars, a depression, and a cold war in the twentieth century, the West retreated. It left behind a residue of ideas, religion, technology, and the English language.

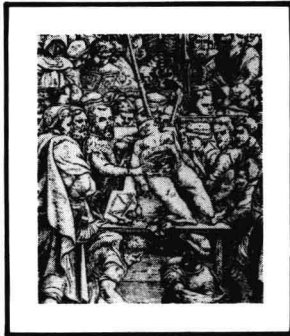
No person, no remote tribe, no plant nor animal has been left untouched by the global penetration of the West. Television and motor cars are everywhere. Wealthy people travel to the Antarctic, the Caribbean, or the Seychelles for vacations. Poor people wear digital wristwatches and listen to transistor radios. Fax machines utilize the telephones. Young people globally are seen wearing American blue jeans and listening to rock music. There is an intermixing of cultures and an interdependence of economies. The human species is culturally richer for all the global interconnection, and at the same time imperiled by global diseases, pollution, and overpopulation.

The purpose of this anthology is to give students a sense of this modern world history with a selection of timely, fresh, and interesting articles from popular sources. The units are organized into large chronological periods with the exception of the first one on the industrial and scientific revolutions. The progress of science and technology is ongoing and has a pervasive influence upon the history of the world. The subject is, moreover, fundamental in the history of the West. There are also other topics—war, urbanization, women's history, for example—cutting through the time periods. Reference to the topic guide will help locate these for you. Along with the topic guide in *Annual Editions: World History, Volume 2*, you can put together a topical reference throughout world history.

It is not a perfect world and this is not a perfect anthology. A world history anthology by its nature must be selective, and not everything can be covered. We would like to have your suggestions and comments about the articles. Please use the article rating form at the back of this volume to help us improve the next *Annual Editions: World History, Volume 2*.

David McComb

David McComb
Editor



Unit 1

The Industrial and Scientific Revolutions

Eight selections discuss the revolution in the industrial and scientific world. Topics include the change from cottage industry to factory, the importance of Galileo, and modern advancements in medicine.

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1. An Early Energy Crisis and Its Consequences, John U. Nef, <i>Scientific American</i> , November 1977. Between 1550 and 1700 <i>Britain</i> substituted coal for wood as its primary energy resource. There was little choice; as people moved to the cities, they used up the forests for fuel and construction. Coal thus became the power source for the Industrial Revolution.	6
2. Cottage Industry and the Factory System, Duncan Bythell, <i>History Today</i> , April 1983. There was no sudden displacement of the cottage industry by the factories of the <i>Industrial Revolution</i> . The change was gradual, taking place over three generations, and the shift was beneficial in the long run.	13
3. Galileo's Science and the Trial of 1633, William A. Wallace, <i>The Wilson Quarterly</i> , Summer 1983. <i>Galileo</i> stands as a transitional figure between the crumbling beliefs of medieval Europe and the power of the new science . However, his arguments for the Copernican system, which placed him at the court of the Inquisition, were weak and based more on intuition than on scientific proof.	20
4. Freudian Myths and Freudian Realities, Peter F. Drucker, from <i>Adventures of a Bystander</i> , Harper and Row, 1979. Sigmund Freud was one of the towering scientific intellects of the twentieth century. He encouraged stories about himself, however, which were far from true.	26
5. The Creation, <i>U.S. News & World Report</i> , December 23, 1991. Theologians and scientists, as might be expected, clashed over the creation of the universe . It is a debate that reaches back to Copernicus, Galileo, and Charles Darwin. Today, there is some concern to bring science and religion together, but a "good faith" effort is needed on both sides.	33

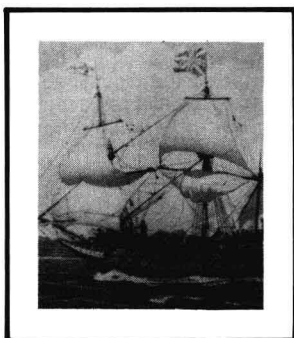


Unit 2

The Ferment of the West, 1500-1800

Six articles examine the cultural development of the West including such topics as early religious thinking, women in eighteenth-century society, and the importance of the American Constitution in world events.

6. **A Curiosity Turned Into the First Silver Bullet Against Death**, Edwin Kiester, Jr., *Smithsonian*, November 1990. 36
The development of *penicillin* during World War II changed human expectations by practically eliminating mortal bacterial illnesses. It was a case of chance discovery in 1928, of curiosity that led to research and practical application.
7. **James Watson and the Search for Biology's 'Holy Grail'**, Stephen S. Hall, *Smithsonian*, February 1990. 41
In 1953 *James Watson* and Francis H. C. Crick determined that the structure of DNA, the "secret of life," was a double helix. Now, Watson is leading a team to identify every gene in human chromosomes. Scientists are closer than ever to an understanding and *control of life* itself. The potential raises serious questions of ethics.
8. **A Fantastic Voyage to Neptune**, Sharon Begley and Mary Hager, *Newsweek*, September 4, 1989. 47
After traveling over 4 billion miles, *Voyager 2* reached the planet Neptune. The tiny Voyager's radio signal has sent back to Earth spectacular pictures of the planets. It has been the most successful *space probe* in history, and after twelve years in flight, it will now exit the solar system to travel endlessly through the stars of the Milky Way
- Overview 52
9. **Luther: Giant of His Time and Ours**, *Time*, October 31, 1983. 54
In 1517 Martin Luther began his protestations against the corruption of the Roman Catholic Church. His actions touched off a revolution in *Christian thought* that started the Protestant movement, spurred the development of new theologies, and, perhaps, saved Christianity as well.
10. **Scotland's Greatest Son**, John Kenneth Galbraith, *Horizon*, Summer 1974. 58
Adam Smith, with his book *The Wealth of Nations*, became the first of the great *economists* and interpreters of capitalism. Although he is still revered, much of what he said must be understood in the context of his time and must be modified by present circumstances.
11. **The First Feminist**, Shirley Tomkiewicz, *Horizon*, Spring 1972. 64
She did not hate men, nor did she deny the traditional roles of *women* as wives and mothers. However, in the late eighteenth century, Mary Wollstonecraft pursued a successful writing career and argued that the female had as good a mind as the male.
12. **A World Transformed**, Keith Michael Baker, *The Wilson Quarterly*, Summer 1989. 69
Ideas about nationalism, liberalism, conservatism, socialism, democracy, and human rights all relate to the *French Revolution*. Although linked to the American Revolution, the revolt of 1789 in France was much more radical.

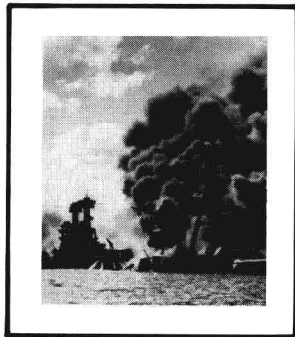


Unit 3

The Expansion of the West

Seven articles show how the West extended and dominated much of the world. Topics include the emergence of Western colonial powers, evolution of Africa, and the French Revolution.

13. **If You Sincerely Want to Be a United States . . .**, *The Economist*, March 23, 1991. 76
 The **U.S. Constitution**, with ideas of an executive branch, limited powers, and judicial respect, has application for the present European community and for the former Soviet Union as they struggle with the problems of unity. The American Civil War, however, is a warning about the critical question of sovereignty.
14. **The Emergence of the Great Powers**, Gordon A. Craig and Alexander L. George, from *Force and Statecraft: Diplomatic Problems of Our Times*, Oxford University Press, 1983. 79
 Between 1600 and 1815 **Great Britain, France, Austria, Prussia, and Russia** emerged as the great powers that would dominate the world up until World War I. This was accomplished through war, diplomacy, efficient bureaucracy, and an attitude which held that the state was more important than any group, individual, or leader.
- Overview 86
15. **Portugal's Impact on Africa**, David Birmingham, *History Today*, June 1988. 88
 Portugal, a small nation on the periphery of the European continent and motivated by poverty, led all of its neighbors in the exploration of the **African coast**. In 1488 Bartholomew Dias reached the Cape of Good Hope and set off five centuries of European colonization.
16. **Attitudes to Africa's Crisis**, Basil Davidson, *The World & I*, August 1990. 94
 Before the advent of slavery, the **European attitude** toward **African peoples** was one of respect. Shakespeare's black character, Othello, for example, was a man of consequence. Conquest gave rise to European feelings of African inferiority, an attitude that lingers today.
17. **Reconstruction in the Southern United States: A Comparative Perspective**, Thomas J. Pressly, *OAH Magazine of History*, Winter 1989. 100
 A **comparison of slavery and emancipation** in Cuba, Zaire, Jamaica, Haiti, Brazil, Russia, and the United States reveals that few former slaves were able to acquire land, receive schooling, or obtain political power. In Russia and Zaire, where the skin color of former slaves and owners was the same, conditions were no better.
18. **China, 1830-1949**, Jonathan D. Spence, *Social Education*, February 1986. 116
China was a conservative country buffeted by internal and external forces of change. There are five broad periods of development between 1830 and the triumph of Mao Zedong.



Unit 4

The Twentieth Century to 1950

Seven articles examine the effect of war and depression on modern world history. Topics include the impact of World War I, the formation of the modern Middle East, Hitler, World War II, and the dynamics of Japan.

19. **China: Rethinking the Revolution**, Zhilian Zhang, *The UNESCO Courier*, June 1989. 120

It took a century before the ideas of the **French Revolution** had an impact in **China**. Governmental corruption, peasant revolutions, and foreign incursions eventually opened the door to revolutionary thought. After embracing French revolutionary ideals, Chinese radicals were ready for violence and bloodshed.

20. **The French Revolution, North Africa, and the Middle East**, Antony T. Sullivan, *The World & I*, July 1989. 123

The developments in the West had no great impact upon the Islamic world until the invasion of Egypt and Algeria by the French. Hopes to use **the ideas of the French Revolution** without compromising **Islamic culture** proved a disappointment.

21. **The French Revolution and Latin America**, Luis E. Aguilar, *The World & I*, July 1989. 127

The Creoles of Latin America rejected the bloodshed, anarchy, and violence of the **French Revolution**. Later romantics gave the French Revolution far greater credit in **Latin America** than its actual contribution.

- Overview 130

22. **Sarajevo: The End of Innocence**, Edmund Stillman, *Horizon*, Summer 1964. 132

The goals of the various nations involved in **World War I** were piteously insignificant when held up next to 10 million dead soldiers. We have yet to recover from the chaos and barbarity of the war.

23. **How the Modern Middle East Map Came to Be Drawn**, David Fromkin, *Smithsonian*, May 1991. 137

Following World War I, the Allies divided the Ottoman Empire. Winston Churchill placed the boundaries of the **Arab Middle East** in a manner suitable for management by the British. In 1990 Saddam Hussein of Iraq contested the boundary of Kuwait, but it was not the first time that the British-drawn borders were attacked.

24. **Architect of Evil**, Stefan Kanfer, *Time*, August 28, 1989. 144

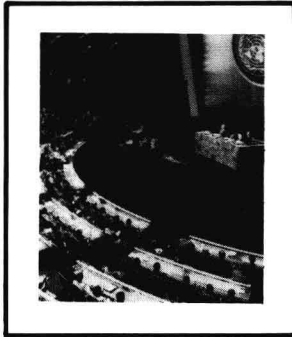
Adolph Hitler thought that the spoken word was more powerful than the written one. He inflamed his audiences with phrases like "Germany, awake!" and became the leader of his nation at age 43. He decided to wage war before he got too old.

25. **The Coming of the Second World War**, John Lukacs, *Foreign Affairs*, Fall 1989. 146

World War I was most important for European nations, while World War II was more significant for the United States. A comparison of events before 1914 and 1939 points out the differences.

26. **Social Outcasts in Nazi Germany**, Jeremy Noakes, *History Today*, December 1985. 151

The slaughter of the Jews in **World War II** has rightly demanded the most attention from the public, but there were others whom the Nazis attacked and eliminated in the gas chambers and work camps. Of the 30,000 Gypsies living in Germany in 1939, only 5,000 survived the war.



Unit 5

The Cold War and a New World Order, 1950 to the Present

Nine articles discuss the evolution of a new world order. Topics include African independence, the Middle East, the dissolution of the Soviet Union, and China.

27. **The Mind of Japan**, James Fallows, *U.S. News & World Report*, December 2, 1991. 156

From the American point of view, the **attack at Pearl Harbor** represented cowardice and deceit. From the Japanese point of view, the event revealed miscalculation and tragedy. Many of the **cultural traits** that led to war continue in contemporary Japan.

28. **Reborn From Holocaust**, Michael Dillon, *The Geographical Magazine*, August 1985. 160

Although Hiroshima has recovered from the 1945 atom bomb blast during **World War II**, the author describes some long-term scars that remain.

Overview 162

29. **A Decade of Decline**, George B. N. Ayittey, *The World & I*, August 1990. 164

After a decade of negative growth, **Africa** teeters on the brink of economic and political chaos. African leaders need to build upon their own native heritage. They also need peace and economic freedom.

30. **Whose Dream Was It Anyway? Twenty-Five Years of African Independence**, Michael Crowder, *African Affairs*, January 1987. 172

The current judgments about **African** political failure have been made in a framework of European hopes. There have been African accomplishments worth noting, while the failures must be shared between the African leaders and their colonial forebears.

31. **Islam: The Roots of Misperception**, Akbar Ahmed, *History Today*, April 1991. 180

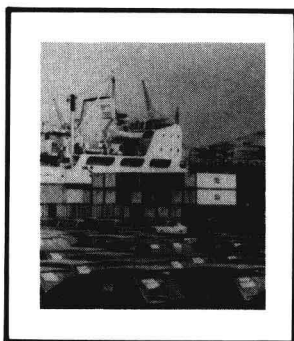
Orientalists who study the **Middle East** from a Western view are as mistaken as Occidentalists who study the West from an Islamic view. Of the various encounters between the Middle East and the West, the one following World War II is the most difficult, because it involves a cultural invasion.

32. **The New English Empire**, *The Economist*, December 20, 1986. 185

Four centuries ago, 7 million people spoke English. Today there are 330 million who speak it as a mother tongue and close to one billion who speak it as a second language. One of the legacies of **colonization** and **technology** is that English has become the world language.

33. **Berlin 1961: The Record Corrected**, Raymond L. Garthoff, *Foreign Policy*, Fall 1991. 190

U.S. tanks faced Soviet tanks at Checkpoint Charlie for almost twenty-four hours in a facedown over authority in Berlin. Recently available documents show that John F. Kennedy used an unofficial line of communication with Nikita Khrushchev to defuse the confrontation. Both sides claimed a triumph for this risky incident of the **cold war**.



Unit 6

Global Interdependence

Five selections examine the effects of interdependence on some world problems including population growth, the AIDS crisis, women's rights, and cultural diversity.

34. **Gorbachev Never Knew What He Was Letting Loose**, 197
Michael Dobbs, *Manchester Guardian Weekly*, December 22, 1991.
Mikhail Gorbachev, the last leader of the Soviet Union, is a mystery. Was he a reformer, liberator, savior, conservative? The **breakup of the USSR** has meant, nonetheless, an end to the **cold war**.
35. **The Return to History: The Breakup of the Soviet Union**, 201
Shlomo Avineri, *The Brookings Review*, Spring 1992.
In historical terms the **fall of communism** is more complex than it appears. It is unclear what will emerge, but a return of old street names, religion, and nationalities indicate an assertion of earlier historical patterns.
36. **The Fading of the Revolutionary Era in Central America**, 206
Forrest D. Colburn, *Current History*, February 1992.
The loss of assistance after the collapse of the USSR has forced revolutionary forces in **Central America** to rethink their position. There is no decline in militancy, but less determination to take control of governments. Instead, the armed leftists are trying to control resources and positions within governments.
37. **White Swan, Gray Turtle**, Robert Kiely, *Harvard Magazine*, 210
July/August 1991.
In **China** the modern mixes with the old. The bloody events of Tiananmen Square are rarely mentioned, and everyone, even the poor, watches television. It seems as if the people of this tortured land are waiting for something to happen.
- Overview 214
38. **Magnificent, But Was It War?** Angelo M. Codevilla, 216
Commentary, April 1992.
The **invasion of Kuwait by Iraq** was the symptom of a disease in the **Middle East**. The symptom was taken care of, but the disease remains.
39. **Squeezing in the Next Five Billion**, *The Economist*, 222
January 20, 1990.
The growth rate is slowing, but **world population** will double during the coming century. The planet may be able to produce enough food. The population, however, will be unevenly distributed and there will be problems of quality of life.
40. **AIDS: The Next Ten Years**, *Newsweek*, June 25, 1990. 225
The **AIDS pandemic** is just beginning. By the end of the 1990s there may be as many as 20 million people infected worldwide, with no cure but death. In the United States, almost everyone will know someone who has the disease.

41. Modernization and the Women of Brazil , Bernard C. Rosen, <i>The World & I</i> , April 1991.	231
Rapid industrialization demanded a reliable work force in <i>Brazil</i> . One result has been that women have been welcomed and this, in turn, has eroded the traditional <i>discrimination against women</i> .	
42. Cultural Diversity: A World View , Thomas Sowell, <i>The American Enterprise</i> , May/June 1991.	234
Diverse cultures, historically, have enriched one another, and no <i>culture</i> has become great by itself. The use of "cultural diversity," however, to create ethnic isolation will result only in "dead-end tribalism" or an "orgy of cultural vanity."	
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Topic Guide

This topic guide suggests how the selections in this book relate to topics of traditional concern to world history students and professionals. It is useful for locating articles that relate to each other for reading and research. The guide is arranged alphabetically according to topic. Articles may, of course, treat topics that do not appear in the topic guide. In turn, entries in the topic guide do not necessarily constitute a comprehensive listing of all the contents of each selection.

TOPIC AREA	TREATED IN:	TOPIC AREA	TREATED IN:
Africa	<ul style="list-style-type: none"> 15. Portugal's Impact on Africa 16. Attitudes to Africa's Crisis 17. Reconstruction in the Southern United States 20. French Revolution, North Africa, and the Middle East 29. Decade of Decline 30. Whose Dream Was It Anyway? 	Environment	<ul style="list-style-type: none"> 1. Early Energy Crisis and Its Consequences 39. Squeezing in the Next Five Billion
Americas	<ul style="list-style-type: none"> 13. If You Sincerely Want to Be a United States . . . 17. Reconstruction in the Southern United States 21. French Revolution and Latin America 36. Fading of the Revolutionary Era in Central America 41. Modernization and the Women of Brazil 	Europe	<ul style="list-style-type: none"> 1. Early Energy Crisis and Its Consequences 2. Cottage Industry and the Factory System 3. Galileo's Science and the Trial of 1633 4. Freudian Myths and Freudian Realities 9. Luther: Giant of His Time and Ours 10. Scotland's Greatest Son 11. First Feminist 12. World Transformed 14. Emergence of the Great Powers 15. Portugal's Impact on Africa 20. French Revolution, North Africa, and the Middle East 22. Sarajevo: The End of Innocence 24. Architect of Evil 25. Coming of the Second World War 26. Social Outcasts in Nazi Germany 33. Berlin 1961: The Record Corrected 34. Gorbachev Never Knew What He Was Letting Loose 35. Return to History
Asia	<ul style="list-style-type: none"> 18. China, 1830–1949 19. China: Rethinking the Revolution 27. Mind of Japan 28. Reborn From Holocaust 37. White Swan, Gray Turtle 	France	<ul style="list-style-type: none"> 12. World Transformed 14. Emergence of the Great Powers 20. French Revolution, North Africa, and the Middle East 25. Coming of the Second World War
China	<ul style="list-style-type: none"> 18. China, 1830–1949 19. China: Rethinking the Revolution 37. White Swan, Gray Turtle 	Geography	<ul style="list-style-type: none"> 42. Cultural Diversity: A World View
Colonization	<ul style="list-style-type: none"> 15. Portugal's Impact on Africa 16. Attitudes to Africa's Crisis 17. Reconstruction in the Southern United States 20. French Revolution, North Africa, and the Middle East 30. Whose Dream Was It Anyway? 	Germany	<ul style="list-style-type: none"> 9. Luther: Giant of His Time and Ours 14. Emergence of the Great Powers 25. Coming of the Second World War 26. Social Outcasts in Nazi Germany 33. Berlin 1961: The Record Corrected
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TOPIC AREA	TREATED IN:	TOPIC AREA	TREATED IN:
Islam	20. French Revolution, North Africa, and the Middle East 23. How the Modern Middle East Map Came to Be Drawn 31. Islam: The Roots of Misperception	Technology	1. Early Energy Crisis and Its Consequences 2. Cottage Industry and the Factory System 6. Curiosity Turned Into the First Silver Bullet Against Death 8. Fantastic Voyage to Neptune 32. New English Empire
Japan	27. Mind of Japan 28. Reborn From Holocaust	Terrorism	24. Architect of Evil 26. Social Outcasts in Nazi Germany
Middle East	20. French Revolution, North Africa, and the Middle East 23. How the Modern Middle East Map Came to Be Drawn 31. Islam: The Roots of Misperception 38. Magnificent, But Was It War?	United States	6. Curiosity Turned Into the First Silver Bullet Against Death 7. James Watson and the Search for Biology's "Holy Grail" 8. Fantastic Voyage to Neptune 12. World Transformed 13. If You Sincerely Want to Be a United States . . . 17. Reconstruction in the Southern United States 33. Berlin 1961: The Record Corrected 38. Magnificent, But Was It War?
Politics	12. World Transformed 13. If You Sincerely Want to Be a United States . . . 14. Emergence of the Great Powers 18. China, 1830–1949 19. China: Rethinking the Revolution 20. French Revolution, North Africa, and the Middle East 21. French Revolution and Latin America 23. How the Modern Middle East Map Came to Be Drawn 24. Architect of Evil 25. Coming of the Second World War 30. Whose Dream Was It Anyway? 33. Berlin 1961: The Record Corrected 34. Gorbachev Never Knew What He Was Letting Loose 36. Fading of the Revolutionary Era in Central America 38. Magnificent, But Was It War?	Urbanization	37. White Swan, Gray Turtle 39. Squeezing in the Next Five Billion 41. Modernization and the Women of Brazil 42. Cultural Diversity: A World View
Population	26. Social Outcasts in Nazi Germany 39. Squeezing in the Next Five Billion 40. AIDS: The Next Ten Years	Warfare	6. Curiosity Turned Into the First Silver Bullet Against Death 14. Emergence of the Great Powers 20. French Revolution, North Africa, and the Middle East 22. Sarajevo: The End of Innocence 23. How the Modern Middle East Map Came to Be Drawn 24. Architect of Evil 25. Coming of the Second World War 26. Social Outcasts in Nazi Germany 27. Mind of Japan 28. Reborn From Holocaust 38. Magnificent, But Was It War?
Religion	3. Galileo's Science and the Trial of 1633 5. The Creation 9. Luther: Giant of His Time and Ours	Women	11. First Feminist 41. Modernization and the Women of Brazil
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The Industrial and Scientific Revolutions

It can be argued that in 1500 the Chinese were at the same technological level as the Europeans. What brought supremacy to the West were the revolutions in industry and science; other civilizations did not experience these changes. Yet, in this history of humankind, it is this phenomenon, along with the early agricultural revolution, that mark the two greatest transformations of the human species. Industrialization started in England, where favorable conditions in the areas of economics, government, and religion prevailed. At the same time England possessed the resources and the opportunity for industrialization. The nation had used up its forests and turned to coal for fuel. As the mining shafts went deeper, drainage became necessary and the Newcomen steam engine, a device designed to pump water from mines, resulted. The engine gave the world portable energy, and people no longer needed to depend upon the vagaries of wind and streams.

Mechanization spread to the English textile industry through a series of inventions that increased the output of weavers and spinners. Factories replaced the small-scale cottage weavers, but the shift was gradual. It was stressful for the workers, nevertheless, and between 1811 and 1816 a band of laborers known as Luddites were severely dealt with for destroying factory equipment. From England, the innovations spread to the mainland and later to the United States and Japan.

The Industrial Revolution was not a revolt in the sense of quick, dramatic uprising. It was slower than that, and the roots go back into the Middle Ages. In a sense, the Industrial Revolution has never stopped, and some historians argue that it continues with the use of robotics in manufacturing and computers to make decisions. Parallel to the Industrial Revolution was the scientific revolution that provided a means of discovering the truth about natural phenomena. This emerged from a shift of interest from religious to earthly affairs during the Renaissance and a loosening of the hold of the Roman Catholic Church during the Reformation.

Copernicus started the scientific revolution in astronomy by placing the sun at the center of the solar system and the Earth as a planet in orbit. Galileo, who combined his technical skills at telescope construction with his scientific curiosity, discovered four new planets, the stars of the Milky Way, the mountains of the moon, and the

moons of Jupiter. This gave credence to Copernican thought. Galileo was a transitional man, however, with one foot in the medieval world and the other in the modern. His arguments for Copernicus, as William Wallace points out, were based more on intuition than fact.

Quite often scientists have sought practical results for their experiments. This can be seen in the articles by Edwin Kiester on penicillin and Stephen Hall on James Watson. Even Sigmund Freud, who first opened and explored the labyrinth of the human mind, sought a practical end in the cure of his patients. The article by Peter Drucker gives insight into this extraordinary man who is considered one of the great intellectuals of the modern world. Another great thinker was Charles Darwin, whose scientific inquiry into the evolution of life brought him into conflict with the traditional stories of creation found in the Bible. The split between science and religion continues today, as summarized in the article "The Creation."

The scientific revolution, like the Industrial Revolution, also continues today, as can be seen in "A Fantastic Voyage to Neptune." The more we can learn about the solar system, the more that we can know about our own planet and the human place in the universe. This might raise further religious questions, as can, incidentally, the work of James Watson in learning how to manipulate genes. Still, the flight of Voyager 2 represents a magnificent triumph for science and technology. It is symbolic of the direction and power of Western civilization.

Looking Ahead: Challenge Questions

What were the characteristics of cottage industry, and why was it replaced by the factory system?

Why was astronomy the leading discipline of scientific inquiry?

How "scientific" was Galileo?

How true was the image that Sigmund Freud liked to give of himself?

Compare the arguments by theologians and scientists about the creation of life on Earth. What is the place of Charles Darwin and James Watson?

Debate the statement that the only good science is applied science (science that has a practical result).

Describe Voyager 2 and its accomplishments. Then answer the question, "So what?"

