Topic 9.1

Advances in Technology and Exchange After 1900

You Will Learn To:

- Identify how the problem of geographical distance was overcome by advances in transportation and communication.
- Describe how new energy technologies increased the production of goods.
- Explain the effects of more effective forms of birth control.
- Explain how the Green Revolution and commercial agriculture increased productivity and sustained the earth's growing population.
- Describe how medical advances increased the ability of humans to survive and live longer lives.

The 20th century saw tremendous advances in various fields, which affected lives worldwide. Technological developments in communication and transportation transformed the world, making it seemingly smaller and increasingly globalized.

Meanwhile, the world's growing population benefited from:

- advances in nuclear energy technology that supplemented electricity needs.
- the Green Revolution's agricultural developments, which expanded food production.

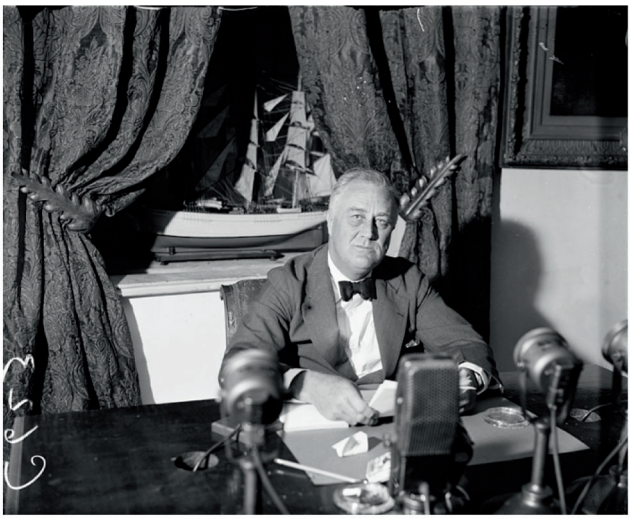
In addition, 20th-century medical developments increased life expectancies and decreased total fertility rates.

Advances in transportation and communication

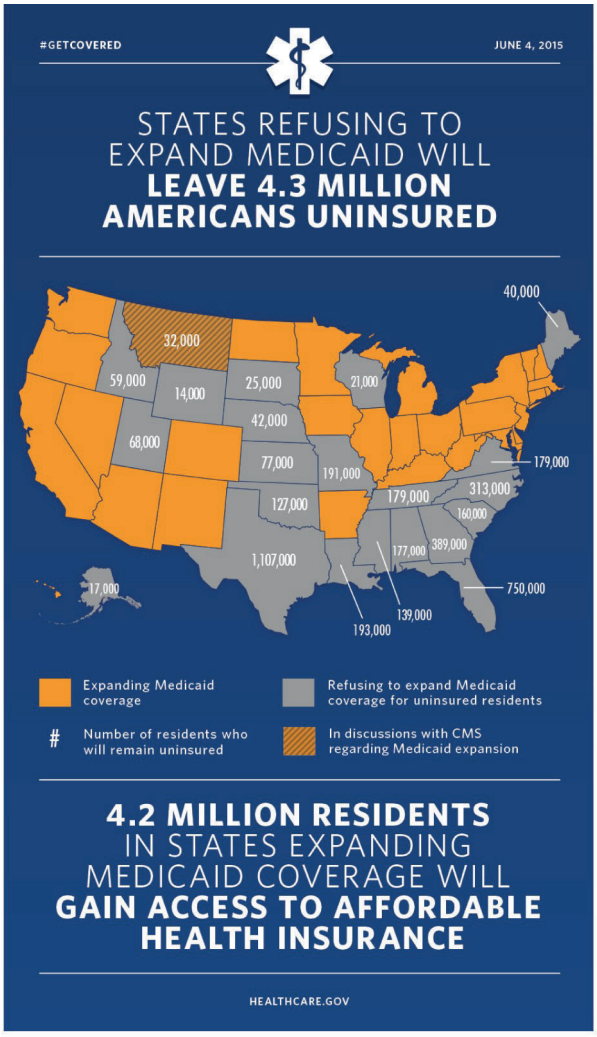
Communication

In the 20th and 21st centuries, new modes of communication were developed, including radio, cellular telephones, and the Internet. These new forms of communication overcame the geographical distances between people, contributing to the spread of a national culture through entertainment and political media.

For example, US President Franklin D. Roosevelt (FDR) used radio communication to influence public opinion. During regular radio addresses called "fireside chats," FDR eased listeners' anxieties and helped Americans feel like the president was talking directly to them amid the hardships of the Great Depression.



Since FDR's fireside chats, other advances in communication have changed how presidents broadcast their agendas to the nation. For example, the Obama administration posted the following graphic on the White House website and shared it through social media platforms such as Twitter, now rebranded as "X":



Source: Obama White House Archive

The graphic was published to persuade voters to urge their state representatives to adopt the expansion. Thus, it illustrates how social media outlets offer new ways for presidents and other political leaders to communicate with voters. Through such technologies, politicians can influence the introduction of new legislation or the adoption of programs like Medicaid expansion, part of the Affordable Care Act.

Today, the political influence of television, talk radio, and social media is more significant than ever, and many have blamed these modes of communication for the polarized political landscape. However, advances in communication technologies—particularly those on the Internet—have positively impacted:

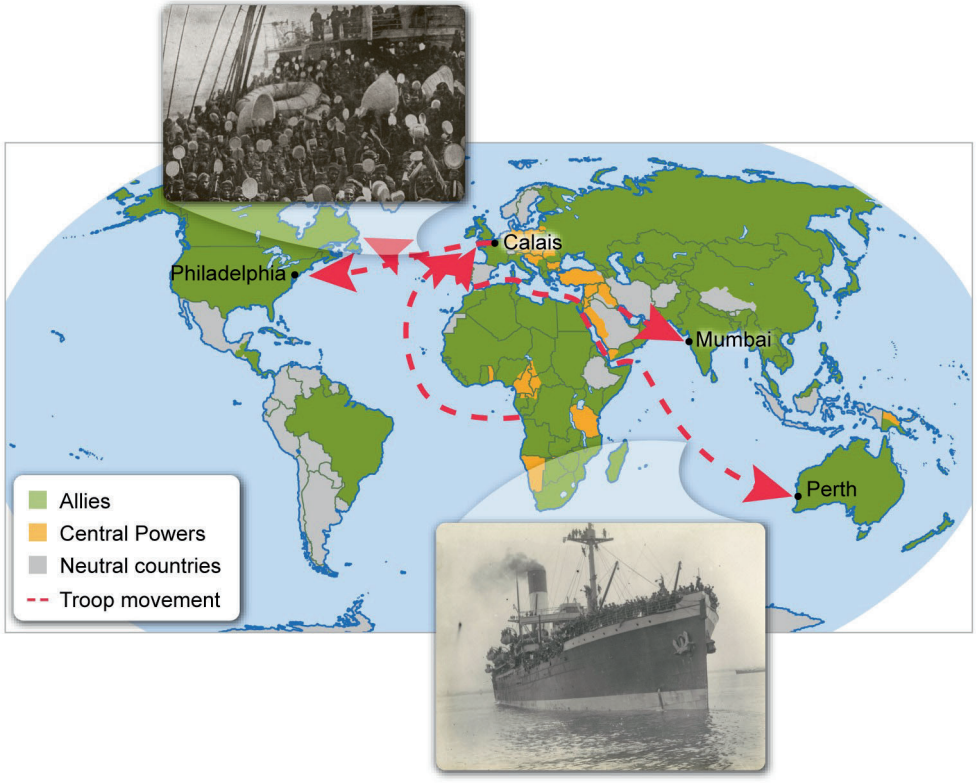
- education, with opportunities for distance learning and online coursework.
- how people buy and sell goods, such as via online shopping sites.

In these ways, technological improvements to communication have offered means for people to overcome problems of geographical distance.

Transportation

New modes of transportation similarly broke down geographic barriers. During the Second Industrial Revolution, the internal combustion engine and new methods of steel production were developed. By the 20th century, internal combustion engines powered trucks, trains, and ships, which became the predominant forms of transportation in industrialized societies.

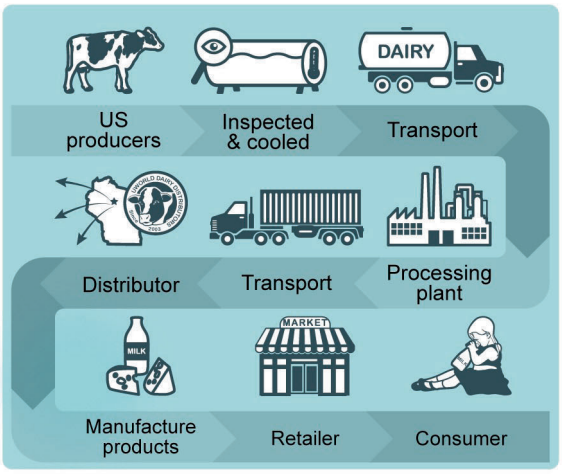
These forms of transportation enabled the movement of larger quantities of cargo, people, and fuel, decreasing the problem of geographical distance between societies. When WWI began, large passenger liners, trucks, and trains transported an unprecedented number of troops across the globe. For example, the British passenger liner RMS Olympic transported 6,000 English troops to Mediterranean war zones.



Commercial aviation also effectively shrank distances between people. Commercial planes began around 1914, although they weren't used for the widespread transport of passengers until after WWI. By 1939, the world's first regularly scheduled transatlantic flight took passengers between New York and Marseilles, France.

Technological improvements during WWII and increasing consumer demand resulted in commercial aircraft that could fly faster with more passengers. As aviation technologies improved, more cities were connected. By the 21st century, further advances in air travel and other transportation technologies allowed connectivity between people in all parts of the world.

Advances in communication and transportation also supported the agricultural developments of the Green Revolution, with specific impacts on the global food chain.



US dairy connection to global supply chain

	2019	Previous year
Mexico	1,531	+11%
Southeast Asia	928	+22%
Canada	807	+3%
China	373	−25%
South America	368	+33%
South Korea	332	+14%
Japan	282	+5%
MENA	274	+8%
Oceania	253	+7%
Caribbean	234	+10%

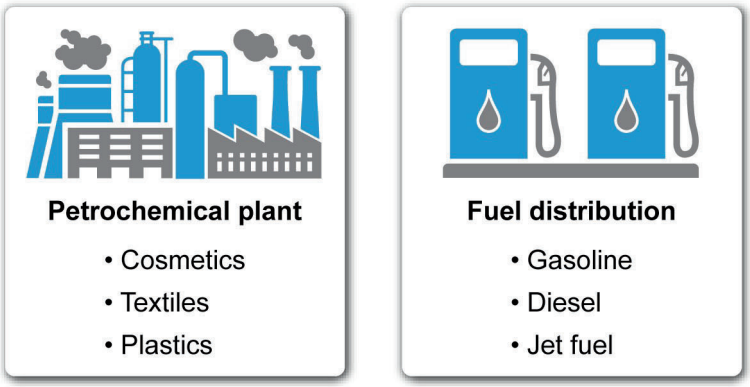
US dairy exports, top 10 markets 2019 (in million $)

Such advances enable the world's food supply to be transported long distances across 21st-century shipping routes, with multiple stops made before reaching consumers' homes.

The world's food supply chain begins in agricultural fields. On its journey between farm and table, the food is processed and moves through the chain on ships, trucks, and trains, with both communication and transportation technologies tracking it along the way. These technologies include global positioning systems and semi-automated transport systems such as containerized shipping.

Increased productivity due to advances in energy technologies

Advances in transportation were closely connected to the advances in energy technologies that powered automobiles, planes, and ships. In the late 19th century, the Fossil Fuel Revolution and the Second Industrial Revolution expanded the manufacturing system. By the 21st century, increases in consumer goods production due to manufacturing improvements and globalization had created a global consumer culture.

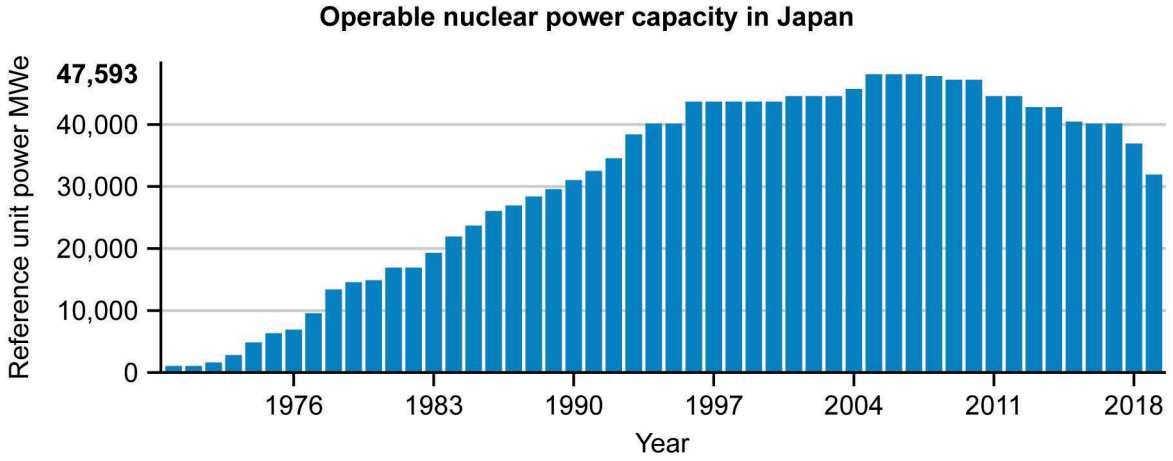


Products derived from petroleum

As consumerism increased, so did the demand for energy and the raw materials required to produce goods. Extraction of petroleum was significantly expanded due to its energy-producing capabilities and its use in industrial chemicals and consumer goods, such as plastics.

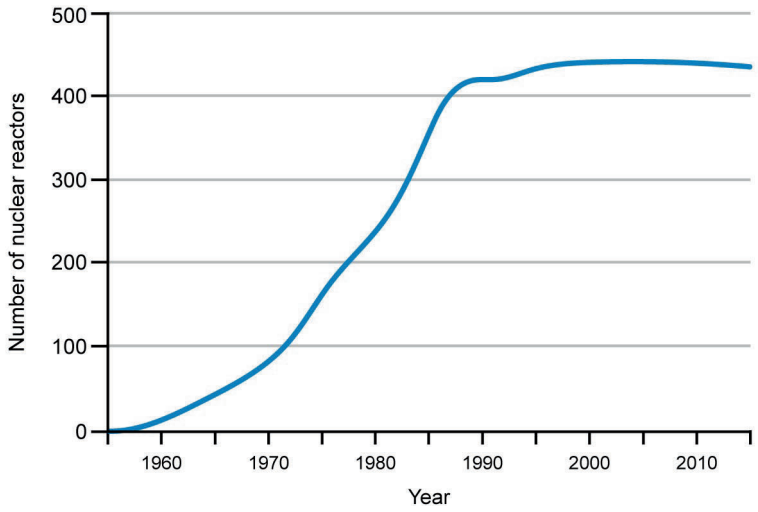
Although electricity and the power for combustion engines were initially obtained from natural resources, the sources of energy eventually expanded. During WWII, the US made significant advancements in nuclear fission, constructing its first nuclear reactor in 1942. Nuclear reactors, at first designed for the atomic bombs used to end WWII, were repurposed to create electricity after the war.

Japan was among the first nations that benefited from nuclear technology as a means of generating electricity. In 1954, propaganda campaigns by the US Central Intelligence Agency convinced the Japanese people of the need for a nuclear program to address the country's lack of energy resources. Due to restrictive laws in the US at that time, Japan signed technological agreements with Great Britain to build a nuclear power reactor.



By the 1970s, US law allowed the transfer of nuclear technology to Japan, resulting in assistance agreements that expanded Japan's nuclear power industry, paving the way for the country's economic growth. Japan's productivity and industrial capacity increased, and by 2011, nearly 30% of its electricity was generated by nuclear power.

In many countries, nuclear power continued providing the required energy to stimulate production and economic growth in the late 20th and early 21st centuries.

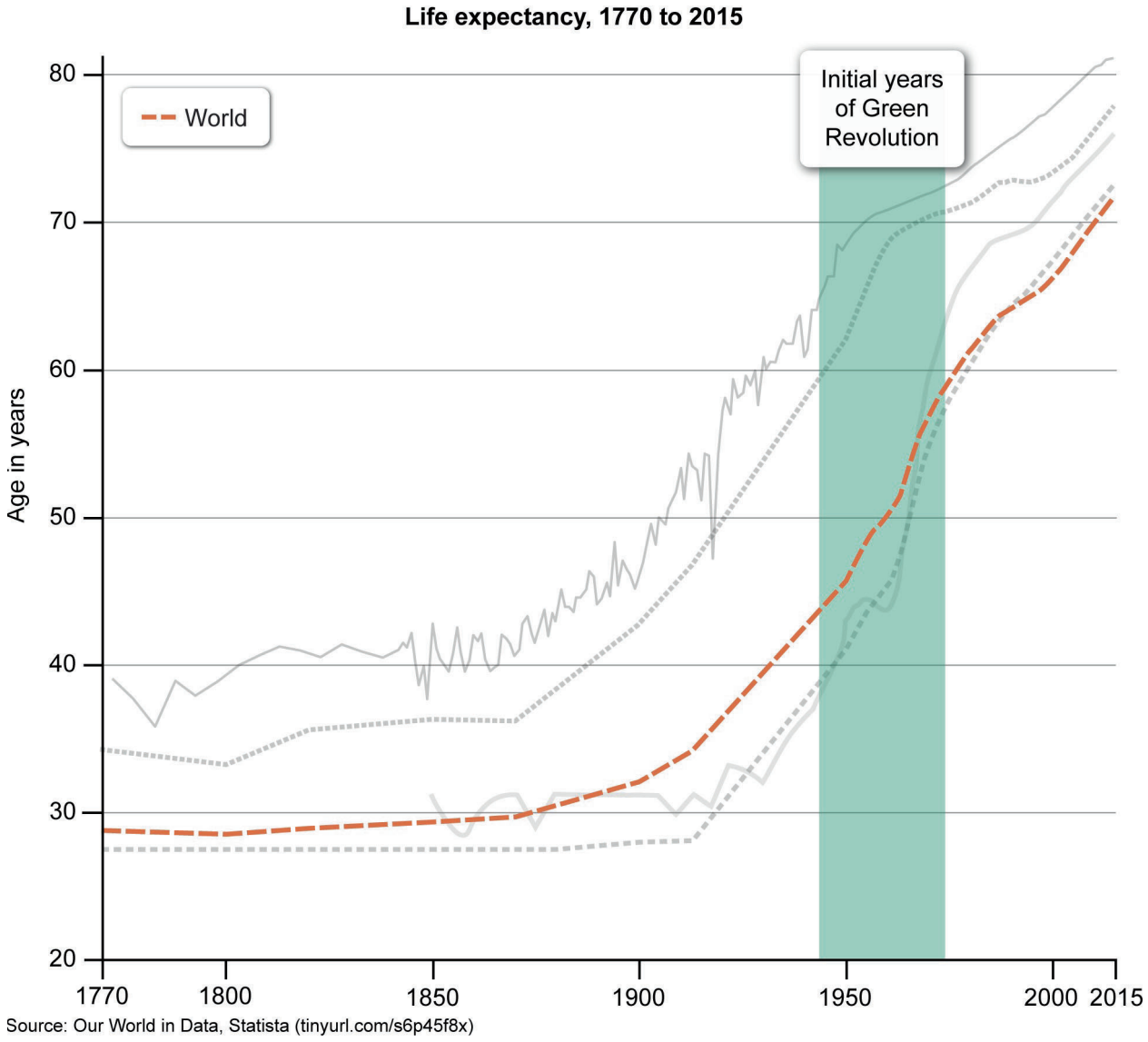


As of 2015, over 400 nuclear reactors remained active worldwide, supplying energy to communities as the world's population grew to 7.4 billion people.

The Green Revolution improves agricultural productivity

Although nuclear power supplemented the world's increased energy needs, the issue of feeding expanding populations posed another problem. By the early 20th century, global population growth was already outpacing food production.

Recognizing this problem in the 1940s, Norman Borlaug, an American scientist working in Mexico, sought to improve wheat production. Borlaug created wheat varieties that were disease resistant, had increased yields, and could grow in different environments. By doing this, Borlaug unknowingly launched the Green Revolution, in which chemicals and genetically modified crops would be used to improve agricultural production and extend average human life expectancies.



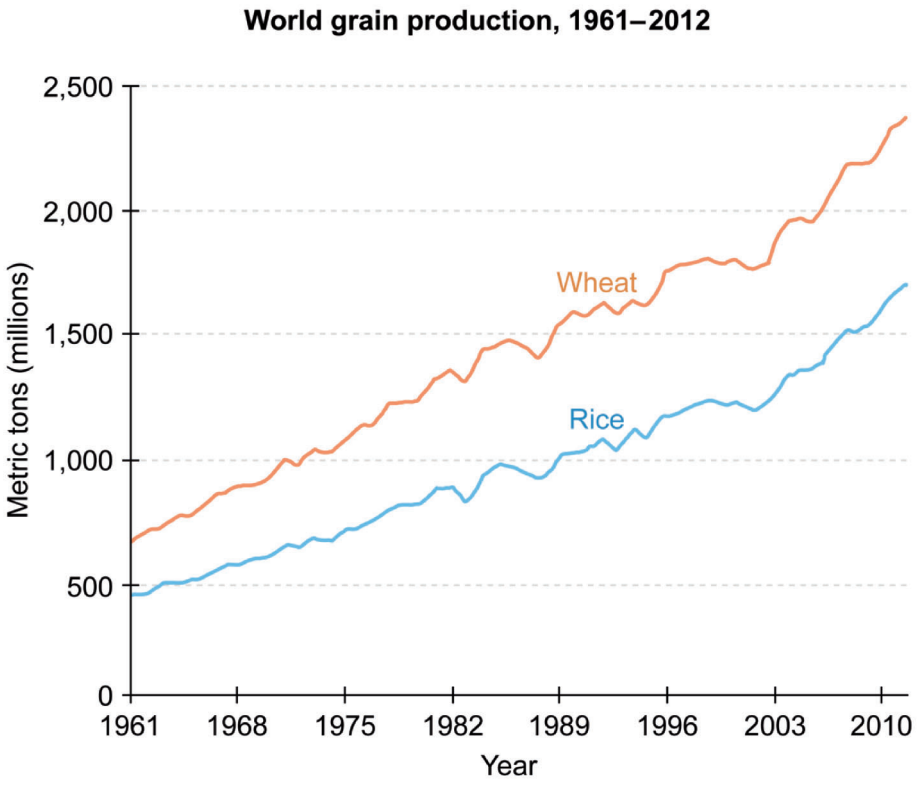
Source: Our World in Data, Statista (tinyurl.com/s6p45f8x)

For example, in the early 1960s, farmers in India used Green Revolution technologies, dramatically affecting the country's agricultural production and economy. Between the 1960s and 1990s, India's rice production per hectare roughly tripled. Today, India is one of the largest producers and exporters of rice and hasn't experienced famine since its use of those technologies began.

Country	Yearly production in 1,000s of metric tons (world rank)	Yield: kilograms per hectare of land (world rank)	Percentage of world production
China	211,094 (1)	6,866 (1)	27.9%
India	163,700 (2)	3,790 (5)	21.6%
Indonesia	79,355 (3)	5,236 (3)	10.5%
Bangladesh	50,453 (4)	4,586 (4)	6.7%
Vietnam	43,112 (5)	5,574 (2)	5.7%

Source: Table 14.2, pg. 169, *Pocket Book of Agricultural Statistics,* Government of India, 2018.

Across Asia, these technologies more than doubled the amount of cereal grain per hectare that was produced previously in the same time frame. Even in fully industrialized nations, cereal grain production nearly doubled, and Green Revolution technologies enabled farmers to produce more food than those countries needed.



Medical developments

Vaccines

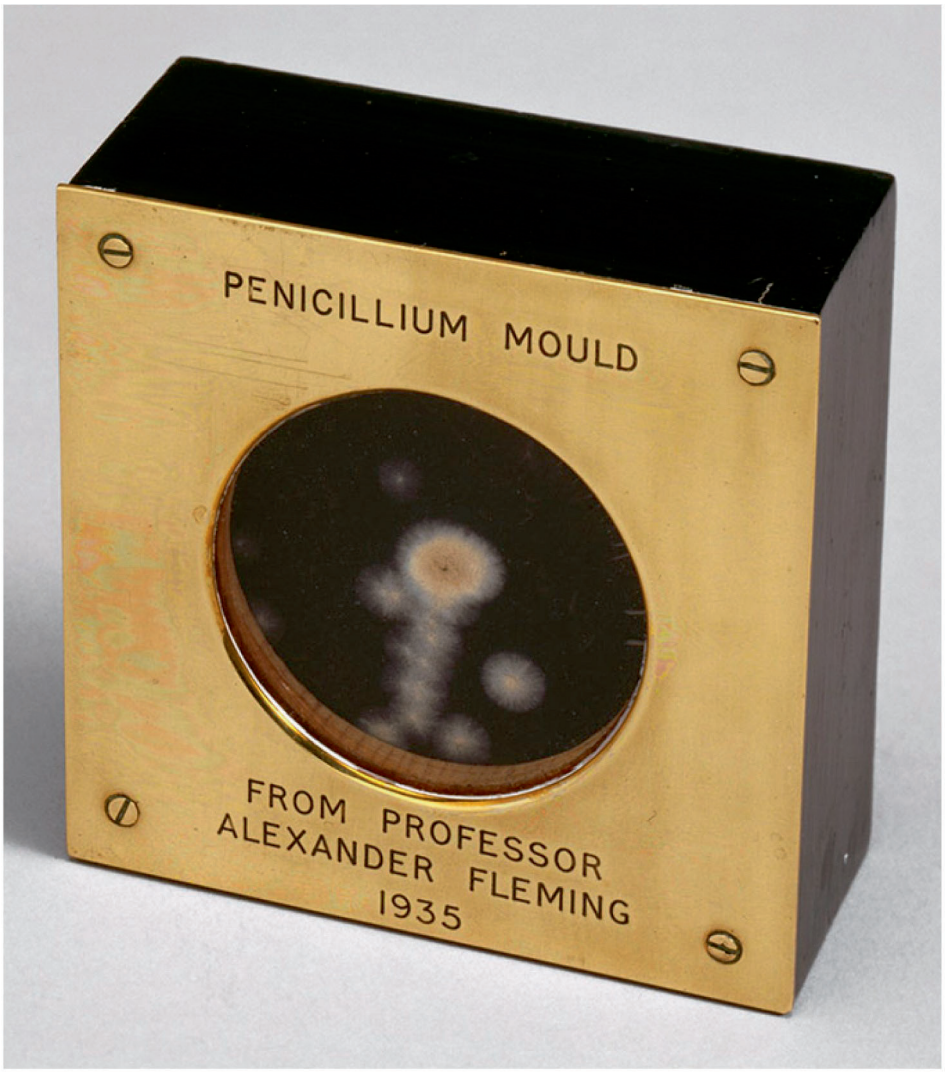
Along with agricultural developments, new drugs and vaccines became available following WWII. Medical supply manufacturers implemented technological innovations, such producing inexpensive plastic syringes instead of glass ones. These advances contributed to vaccination efforts aimed at eliminating certain diseases.

Starting in the 1950s, the United Nations (UN) launched vaccination campaigns to fight diseases across Africa, including malaria and yellow fever. Along with other factors, the vaccinations significantly impacted Africa's population growth, increasing life expectancy and reducing incidences of communicable diseases.

Although average life expectancy among Africans varied by region, in 1950 it was approximately 35 years. By 1970, the age had risen to approximately 45 years. The UN's continued efforts to improve lives and fight diseases increased Africans' average life expectancy to over 60 years by 2015, although diseases such as AIDS and Ebola continue to negatively impact life expectancy on the continent.

Antibiotics

In addition to vaccines, the development of antibiotics was a medical breakthrough in the 20th century that extended the average human life expectancy. Prior to the 20th century, infectious diseases such as smallpox, cholera, and tuberculosis contributed to global life expectancies under 50 years.



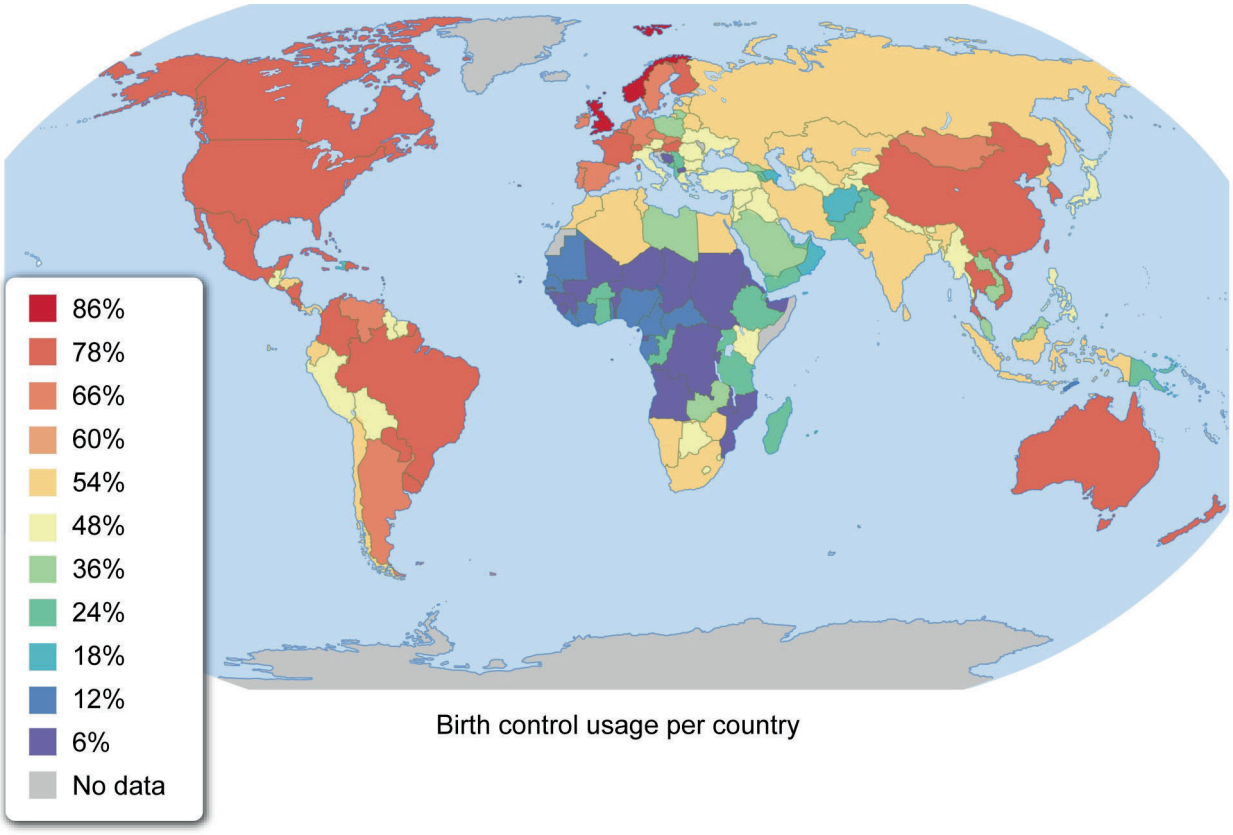
Source: Wikipedia, Science Museum London, CC BY-SA 4.0 International (tinyurl.com/2tfuh65v)

However, Sir Alexander Fleming's discovery of penicillin in 1928 helped extend peoples' lives worldwide. During WWII, purified penicillin was needed in the treatment of injured Allied troops; this led to a mass production system for the antibiotics made from penicillin. Between 1950 and 1970, other lifesaving antibiotics were also developed. Since Fleming's discovery, antibiotics have significantly impacted medicine and lengthened the average lifespan by over two decades.

Birth control and its impacts

Besides new drugs for disease prevention and treatment, the 20th century brought another medical development: a new birth control method—an oral contraceptive—which significantly impacted women's lives worldwide.

For centuries, most women had limited access to traditional methods of birth control, which when used were often ineffective, so fertility rates remained high. Beginning in the late 19th century, technological developments led to contraceptive devices that were inexpensive and more reliable. Access to such methods of birth control, along with family planning and education, reduced fertility rates across many industrialized nations.



Birth control usage per country

In 1960, scientific innovations in medicine resulted in the US Food and Drug Administration approving the first oral contraceptive, called "the Pill." As the Pill increased in popularity, it became more accessible to women globally. Consequently, this new form of birth control, along with the most effective old forms, contributed to declining rates of fertility around the world.

Things to remember

- In the 20th century, the problem of geographical distance was reduced by advances in transportation and communication, increasing people's exposure to politics and their ability to move about between societies. However, easier and more accessible transportation also had negative impacts, including the faster transmission of infectious diseases, such as Ebola.
- Also during the 20th century, improvements in energy technologies such as nuclear power—as developed and used in Japan, Great Britain, and other countries—multiplied productivity and the production of material goods. The rise of a global consumer culture dramatically increased the demand for petroleum, negatively impacting the environment.
- In the second half of the 20th century, Green Revolution technologies greatly increased global grain production through the development of genetically modified crops, helping to sustain Earth's growing population.
- Medical advances in antibiotics and vaccines throughout the 20th century extended average life expectancies. In addition, greater access to effective methods of birth control impacted women's lives and contributed to declining fertility rates in much of the world.

9.1 Check for Understanding

1. **Which of the following is an example of a positive effect that modern communication technologies have had at an individual level?**

   A. They have created a polarized political landscape.

   B. They have helped increase educational opportunities.

   C. They have increased corporations' profits via online sales.

2. **Which of the following was an effect of developing the internal combustion engine?**

   A. The engines worsened the problem of geographical distance between societies.

   B. The engines enabled the faster movement of larger quantities of cargo and people.

   C. The engines eliminated the need for global positioning systems and containerized shipping.

3. **Which of the following countries helped Japan build its first nuclear power plant in the 1950s?**

   A. Great Britain

   B. The Soviet Union

   C. The United States

4. **Which of the following best describes the central aspect of the Green Revolution?**

   A. Using heirloom seeds on organic farms that prohibit synthetic fertilizers

   B. Reducing the amount of wastewater dumped on crops to prevent soil erosion

   C. Improving agricultural production via chemicals and genetically modified seeds

5. **Which of the following statements is true regarding the development of vaccines?**

   A. Vaccines have eradicated Ebola and diabetes across Africa.

   B. Vaccines have increased average life expectancies across Africa.

   C. Vaccines were ineffective until the development of plastic syringes.

6. **Which of the following people is most associated with penicillin?**

   A. Louis Pasteur

   B. Norman Borlaug

   C. Alexander Fleming

7. **What was a significant effect of "the Pill?"**

   A. It contributed to declining fertility rates worldwide.

   B. It led to rising homelessness rates in Western Europe.

   C. It increased fertility rates in most industrialized nations.