

Science and Technology in Society

Science and technology have both had an immense impact on society. The houses we live in, the food we eat, the vehicles we drive, and the electronic gadgets we use to communicate and to educate and entertain ourselves, are all products of scientific and technological achievement (Figure 1).

Many important discoveries and inventions have occurred within the last century—vaccinations against diseases, antibiotics, tranquilizers, organ transplants, reproductive technologies, genetic engineering, microwave heating, computers, lasers, plastics, television, and the Internet. You don't have to look far to find an example of the impact of science and technology on society.



(a)



(b)



(c)

Figure 1 Examples of science and technology in our daily lives: (a) the smart car, (b) the Apple iPhone, and (c) portable DVD players

TRY THIS: *The Greatest Discovery or Invention of All Time*

Skills Focus: observing, analyzing, communicating

Of the numerous achievements in science and technology, most do not have a profound effect on society. Some achievements, however, stand out because they fundamentally change our culture.

1. In a small group, brainstorm a list of discoveries or inventions that have significantly changed our culture. Consider discoveries or inventions such as the heliocentric model of the solar system, the printing press, the telephone, antibiotics, and the internal combustion engine. Follow the brainstorming rules provided by your teacher.
2. After the brainstorming period, discuss each of the discoveries and inventions you came up with and identify the ten most important.
3. Rank the top ten from most important (1) to least important (10).
 - A. Explain why the number one ranked discovery or invention was considered by your group to be the most important.
 - B. Did your group unanimously agree on which discovery or invention was ranked number one? What arguments were made for or against ranking it number one?

One area in which the combination of science and technology has had a large impact is in the medical field. Medical knowledge and technologies have increased life expectancy, particularly in developed countries. On average, we are living longer and healthier lives because science and/or technology have found cures for diseases and treatments for illnesses. Similarly, as the field of molecular biology develops, this knowledge is used to develop new technologies and applications. Genetic engineering was possible only after the structure of DNA was understood.

Recent developments in tissue culture have made it possible to “grow” replacements for organs that have been damaged by injury or disease. In 2006, it was announced that an American research team had successfully grown bladders from patients’ cells in the laboratory, and successfully transplanted the organs back into the patients (Figure 2). Researchers are continuing work on growing different tissues and organs, including blood vessels and hearts, in the laboratory. Research is also being conducted on new protein-based drugs that encourage damaged organs to repair themselves. In animal trials, new drugs that stimulate the re-growth of muscle tissue that has died after a heart attack have been tested successfully.

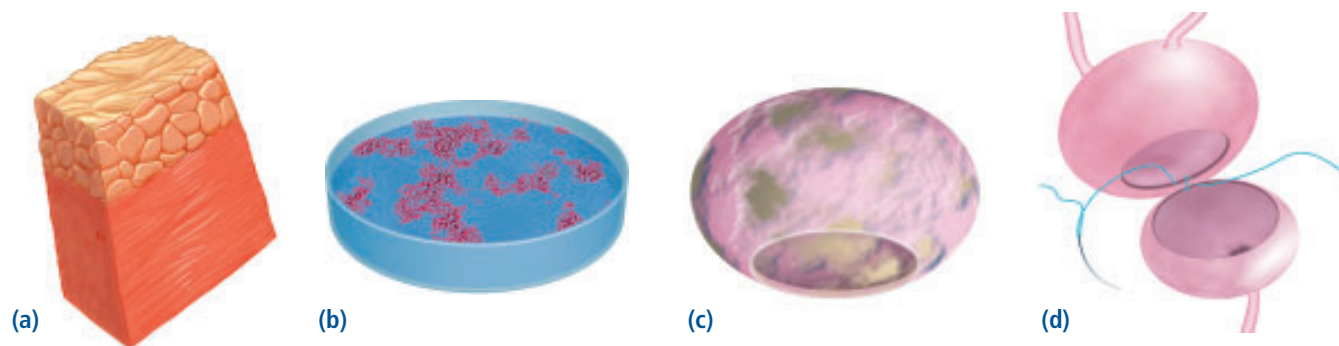


Figure 2 (a) Muscle and bladder cells are extracted from a small piece of the patient’s own bladder. (b) They are grown in a Petri dish and (c) then layered onto a mould shaped like a bladder. (d) In a few weeks, the cells reproduce to grow a new bladder, which is then transplanted into the patient. The new bladder continues to grow to a normal size and starts functioning.

The development of communication technologies, including television, telephones, and satellites, has “shrunk the world.” While the physical Earth has not changed in size, achievements in transportation and communication technologies have made us more aware of what is going on around the world. In less than a day, we can travel to the other side of the world. In an instant, we can see what is happening on the other side of the world. We can see and talk to friends and family in distant countries as if they were in the next room.

The invention of the telephone and all of the related innovations that followed have significantly changed our culture. With cellular and satellite telephones, communication is possible from any location on Earth. The influence of the telephone has been largely positive, and has led to the development of technologies such as handheld and vehicle GPS devices.



Figure 3 Handheld and vehicle GPS devices are convenient and accurate enough for everyday use.

These devices are accurate enough to pinpoint locations to within 10 m (Figure 3). This is more than adequate for establishing your location in the wilderness and finding your way back home or navigating in a busy unfamiliar city. The cost of these devices has decreased so that they are affordable for many people. Some would argue, however, that the telephone and related technologies have also had a negative influence on society. We have technology that enables us to work anywhere and anytime, so that our work lives and our personal lives are no longer separated.

Science and technology have been described as a double-edged sword. This expression is used to describe anything that can both help and hinder, or anything that has both risks and benefits. There are both risks and benefits associated with many scientific discoveries and technological inventions. While most technologies are developed with the intention of solving problems, there are often unintended consequences associated with their use. For example, the chemical DDT is an effective pesticide that controls the populations of disease-carrying insects, but it has been more recently found to have a devastating effect on the eggs of peregrine falcons and bald eagles. Another example of a technology with unintended consequences can be seen in chlorofluorocarbons (CFCs), a common, non-toxic chemical that was commonly used as a refrigerant. After many years, it was discovered that CFCs were contributing to the reduction of Earth's ozone layer, a layer in the atmosphere that protects us from harmful radiation. Similarly, the radioactive wastes produced in nuclear generating stations also create a serious environmental concern and potential health risks because we do not have a satisfactory disposal method. However, the benefits of the radiation-related medical technologies that enable diagnosis and treatment are immeasurable.

It is difficult, if not impossible, to foresee all of the consequences that might arise from using specific technologies. Furthermore, new applications of scientific knowledge and technological inventions are often developed long after the discovery or the invention occurred. In many cases, it is not science or technology itself that is to blame; it is the human use of the knowledge or technology that has negative impacts on society and the environment.

Society Affects Science and Technology

That science and technology influence society is obvious. But do you know that the values and priorities of society at a particular time can also influence the direction and progress of developments in both science and technology?

Scientific and technological research is very expensive. Research facilities employ highly paid and highly skilled professionals. They consume large amounts of energy and require expensive and sophisticated tools and equipment. Funding for research comes from both private and public sources.

LEARNING TIP •

Approach text with a critical eye. As you read the section Society Affects Science and Technology, ask yourself, "Does this information reinforce, contradict, or add new information?"

Basic research is research that helps people learn more about how the natural world works (Figure 4). Basic research in areas such as medicine, alternative energy sources, food supplies, and natural resources, usually receives funding from government agencies, such as the Natural Sciences and Engineering Research Council of Canada (NSERC) and the Social Sciences and Humanities Research Council of Canada (SSHRC). Basic research often produces knowledge that is used by engineers and technologists to develop practical solutions to everyday problems. The priorities of government, representing the priorities of the public, determine which areas of research are funded. For example, if a cure for AIDS is deemed to be a social priority, funding for research in this area will become a priority. If protection of the environment is a public priority, then research into alternative energy sources will likely be promoted and funded.

Applied research is research that is primarily focused on developing new and better solutions to practical problems. Research into the development of consumer products—such as new cosmetics, telephones, automobiles, computer software and hardware, and sports equipment—is usually carried out in privately owned and funded facilities. The marketplace, or the public demand for new products, will obviously influence which areas of research private companies fund. If market analysis shows that there is a demand for new electronic gadgets such as cell phones or video games (Figure 5), research and development in these areas will be supported.

LEARNING TIP •

Check your understanding of the terms “basic research” and “applied research” by explaining the differences to a partner.



Figure 4 A meteorologist studies weather patterns only to learn more about weather and climate trends. This knowledge may then be used to develop solutions to weather-related problems.



Figure 5 The demand for electronic gadgetry to entertain us ensures that funding will be available for further research.