**Science and technology**

As we approach the new century, many questions are raised concerning rapid scientific and technological development and its impact on people’s lives in the future. One thing is certain about the century or even the millennium ahead. The pace of discovery is sure to be even faster than it is today and the social and ethical issues created by the exploitation of new knowledge even more pressing.

The beginning of modern science dates back to the Renaissance period in Europe. It should be noted that some considerable achievements were made long before. Ancient Greek mathematicians and astronomers had calculated the circumference of the Earth, charted the stars and worked out the distance to the moon. Chinese scholars had developed a seismograph, a magnetic compass and the concept of infinite empty space. Euclid’s geometry, Ptolemy’s geography and Galen’s medicine had provided a good starting point for their followers hundreds of years later. However, not until the 16th century did scientists begin to apply the use of mathematics to measure the results of experiments. This approach laid the foundations for the methodological model that guides most scientific research today: develop hypothesis, run tests and produce data that other researchers can confirm or challenge by conducting similar experiments.

People who want to push forward the frontiers of scientific knowledge often need to challenge the conventional wisdom. Such wisdom once assumed that the universe was static and unchanging. Now an expanding universe and the big bang theory are essential concepts of cosmology, the part of astronomy that studies the origins of the universe and its time-space relationships. Just a few hundred years ago, in the 16th and 17th centuries, most Europeans thought that the sun revolved around the Earth and that four elements – air, fire, water and earth created and defined life. Then pioneers such as Galileo Galilei and Isaac Newton demonstrated that the natural world can be best understood by experimentation and analysis. Behind each of the great ideas, discoveries and inventions is an extraordinary human mind. Here are some of the greatest names and their advances that shaped the scientific and technological history: In 1543 Vesalius published the first accurate human anatomy and Copernicus came up with the theory that the Earth and other planets revolve around the sun. In 1572 Brahe’s observations proved that celestial bodies are not unchanging. Kepler set out laws of planetary motion in 1609. In 1687 Newton drew up laws of gravity and motion and his theory of optics appeared in 1704. Leeuwenhoek discovered organisms in 1674. The study of electricity and magnetism advanced rapidly after Volta invented the electric battery, the first source of current electricity, in 1800. Faraday demonstrated electromagnetic induction in 1831. Dalton set out an atomic theory of matter in 1808. In 1857 Pasteur reported that microorganisms cause fermentation which resulted in later pasteurization of food. Two years later Darwin published “The origin of Species”. The periodic table of elements by Mendeleyev came out in 1871. Röntgen discovered x-rays in 1895.

However, the real scientific revolution did not take place until the 20th century. It is the century that split the atom, explored the human mind, spliced genes and cloned a sheep. It invented plastic, radar and the silicon chip. It built airplanes, rockets, satellites, televisions, computers and atom bombs. It overthrew our inherited ideas about logic, language, learning, mathematics, economics and even space and time. Theses dramatic advances were made possible by the following scientific breakthroughs: By 1920 quantum mechanics was adopted and Einstein’s theories of relativity appeared. Hubble realized in 1929 that galaxies recede from one another in an expanding universe. Paradoxically, World War II stimulated scores of inventions namely the nuclear reactor first put into service in 1942, and the general-purpose digital computer, first used in 1945. In 1948 the transistor, forerunner to the computer chip, made computers commercially practicable. The structure of the DNA molecule was discovered in 1953 by Watson and Crick. Sputnik 1 and 2, Earth’s first artificial satellites, were launched in 1957. In July 1969 the U.S. spaceship Apollo landed on the moon. As the year 2000 approaches, the Human Genome Projected catalogues our genes, the Internet links scientists worldwide, and the Hubble telescope, in orbit since 1990, transmits intergalactic views.

The 20th century has also turned science into the principal agent of technology. Science has, however, come to depend on technology for its new instruments, such as powerful telescopes, atom smashers and computers. Advances in genetics and astronomy are driven by the growing capabilities of faster computers and by improved imaging techniques that make microscopes and telescopes more powerful. Such tools enable scientists to see things they had never seen before or even considered possible. Genetic researchers can examine objects that are only a millionth of an inch in diameter, while astronomers can see galaxies perhaps 11 billion light-years away.

This century has made science more exacting. We demand more of its explanations. To say that the Earth goes around the sun is no longer sufficient; we insist on knowing why. And in some fields – space research, for example – decades can pass while new instruments are designed and built.

One of the most significant effects of the scientific revolution has been population growth. Until modern science brought new systems of immunization in the 19th century, about half of all children died before the age of five. Surely nothing has done more for the comfort and happiness of mankind than the development of medical knowledge.

Every discovery provokes new questions. The more we know, the more we do not know. To predict what lies ahead, we must often rely on guesses. Our present ignorance points to problems science cannot avoid, as every assertion about the nature of the world must be proved by experiment or observation. Some of the major scientific and philosophical issues for the next century include the beginnings of life. How life began is an essential question that will occupy most of the next century. Modern gene technology can use the DNA in every living thing as a vast repository of historical information. Figuring out how the chemical operations essential for survival are carried out within every cell of living creatures is an extremely complex task. The Human Genome Project aims to specify the location and structure of all genes in the human body. It will provide information that could help us understand what all genes do. This project could result in surer design of drugs, in the growth of replacement of organs, in the early detection and treatment of many kinds of diseases, including cancer. In the field of human evolution there is to be learnt what genetic changes made it possible for the ancestors of modern people to stand upright and then to speak. Thus it would be also possible to trace migration routers of our human ancestors who emigrated from Africa and came to populate the surface of the earth. By no means will a less difficult puzzle be the human brain and the way it works. Last but not least, the Big Bang theory will have to be further developed to give more satisfactory account of the true nature of our universe.

Will scientific progress continue or will it reach certain limit? We should discard the idea that scientific inquiry will ever be complete. However, there may be some limits and restrictions for modern science, namely moral and ethical. Scientists and society will have to decide how much to change the genetic structure of plants and animals and to what extent experiment with the very genes that make us human. In the meantime the achievements and challenges of modern science will drive us further in to the unknown.