TIMELINE – CHAPTER 5

THE HUMAN ORGANISM AND THE PERPETUATION OF LIFE

2003 Decoding of human genome is completed

Decoding of the human genome was made possible thanks to an ambitious international project that lasted 13 years, two years less than had been initially projected. With the participation of six countries—Germany, China, the United States, France, Japan and the United Kingdom—the Human Genome Project was launched in 1990. Its mission: a broad program for the identification, mapping and analysis of the human genome. Its efforts were coordinated by the international organization known as HUGO (Human Genome Organization). In 2000 most of the genome had been decoded, then in 2003 the sequencing (determination of the order of the bases of DNA) was completed. Today we can count almost 25 000 human genes, far fewer than scientists had anticipated at the beginning of the project.

1972 First mouse born from a frozen embryo

Techniques for freezing of human embryos derive directly from those developed for mouse embryos. The first successful freezing that led to the birth of a mouse was performed by American biologist D.G. Whittingham and his team. The embryos survived a temperature of –196°C.

1953 Discovery of the double-helix structure of DNA

Discovery of the three-dimensional structure of DNA was published in the respected science magazine *Nature* by British biologist Francis Crick and American biochemist James Watson. Along with British physicist Maurice Wilkins, the two scientists received the Nobel Prize for Medicine in 1962 for the discovery. British molecular biologist Rosalind Franklin also participated in research leading to this discovery, but was never publicly recognized—she succeeded in taking X-ray photographs of DNA.

1944 Discovery that DNA carries genetic information

Before 1944 most scientists believed that the molecule present in chromosomes (and bearer of genetic information) was proteinaceous in nature. Canadian-born American bacteriologist and physician Oswald Avery proved with his colleagues that DNA plays an important role in the transmission of genetic information (thus, this molecule is the basis for heredity). While working with samples of pneumococcus (the bacteria responsible for pneumonia), they found that genes and chromosomes, carriers of genetic information, are made of DNA.

1933 Invention of the electron microscope

In Berlin, Germany, physicist Ernst Ruska and engineer Max Knoll perfected the first electron lenses and created the first electron microscope. With this instrument, light is provided by a beam of electrons instead of by a beam of light as with an light microscope. The images obtained are far more detailed than those of an light microscope: an enlargement of up to a million times can be achieved with an electron microscope, whereas a maximum of 2 000 times is possible by using an light microscope.

1904 Discovery of sex chromosomes

The role of X and Y chromosomes in determining gender (XX for women and XY for men) was discovered separately in the same year by American geneticist Nettie Stevens and American zoologist and geneticist Edmund Wilson. The system of sex determination applies not only to humans, but also to most mammals.

1902 Discovery of hormones

English physiologists Ernest Starling and William Bayliss discovered the first hormone: secretin. This is accepted as the basis for endocrinology. Over a series of experiments on the digestive system, these scientists showed that secretin, which is secreted by the intestine, stimulates digestive enzymes in the pancreas. The concept that hormones act as a chemical messenger between organs became clearer in the following years with the discovery of other hormones such as insulin, thyroxin (a hormone in the thyroid gland), sex hormones and growth hormones. Since the 1920s isolating hormones and creating them through synthesis has been possible.

CIRCA 1901 Discovery of the role played by the cell membrane

The membrane that contains the cell, also called *plasmic membrane* or *cytoplasmic membrane*, does more than simply keep the cell together. English microbiologist Charles Ernest Overton discovered that the cell membrane is permeable and controls its exchanges with its surroundings. He hypothesized that the membrane is lipid in nature.

1831 First observations of the nucleus of a cell

While observing epidermic cells of orchids under a microscope, English botanist Robert Brown discovered a large structure inside a cell: the nucleus. He later discovered the same structure in other vegetable tissue and other species. This discovery confirmed the cell theory that all living things are made of cells with a similar fundamental structure.

1824 Discovery of the function of spermatozoa

Sperm were first discovered by Antonie Van Leeuwenhoek in 1680. The role of sperm in fertilization was later determined by Swiss doctor Jean-Louis Prévost and French chemist Jean-Baptiste Dumas, who stated that spermatozoa are the active agents in fertilization. They demonstrated that sperm need to penetrate an egg for an embryo to develop.

CIRCA 1680 First observations of microscopic organisms

Dutch naturalist Antonie Van Leeuwenhoek made an improved single-lens microscope and observed a number of species invisible to the naked eye. He was able to observe and describe microscopic organisms living on human teeth, spermatozoa (which he called *animalcules of the semen*) in sperm, protozoa in swamp water, and blood cells.

CIRCA 1590 Invention of the multiple-lens microscope

Dutch lensmakers Hans and Zacharias Janssen built the first multiple-lens microscope: one lens for the object and one for the eyepiece. At the time many scientists still preferred to use the single-lens microscope and rejected the multiple-lens microscope because its images were blurry and misshapen at the outer borders due to the phenomenon of chromatic aberration. This fault was corrected by John Dollond in the mid-18th century.

1420 First artificial fertilization of fish eggs

One of the first experiments in artificial reproduction was performed in France by the monk Dom Pichon who wanted to restock the rivers. He developed a system to fertilize trout eggs, then hatch them. Close to three centuries later, around 1730, German Stephen Jacobi perfected this fertilization technique for trout and salmon.