The Cell

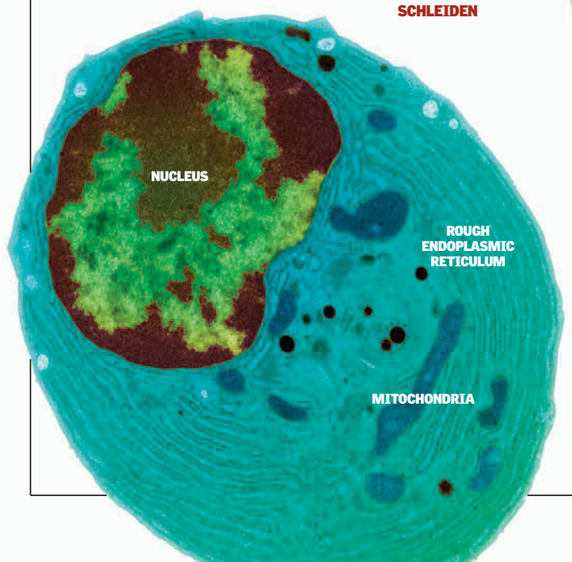
It is the smallest unit of the human body—and of all living organisms—able to function autonomously. It is so small that it can be seen only with a microscope. Its essential parts are the nucleus and cytoplasm, which are surrounded by a membrane. Each cell reproduces independently through a process called mitosis. The animal kingdom does have single-celled organisms, but in a body such as that of a human being millions of cells are organized into tissues and organs. The word "cell" comes from Latin; it is the diminutive of *cella*, which means "hollow." The science of studying cells is called cytology. ●

Cell Theory

Before the invention of the microscope, it was impossible to see cells. Some biological theories were therefore based on logical speculations rather than on observation. People believed in "spontaneous generation" because it was inconceivable that cells would regenerate. The development of the microscope, including that of an electronic version in the 20th century, made detailed observation of the internal structure of the cell possible. Robert Hooke was the first to see dead cells in 1665. In 1838 Mathias Schleiden observed living cells, and in 1839, in collaboration with Theodor Schwann, he developed the first theory of cells: that all living organisms consist of cells.

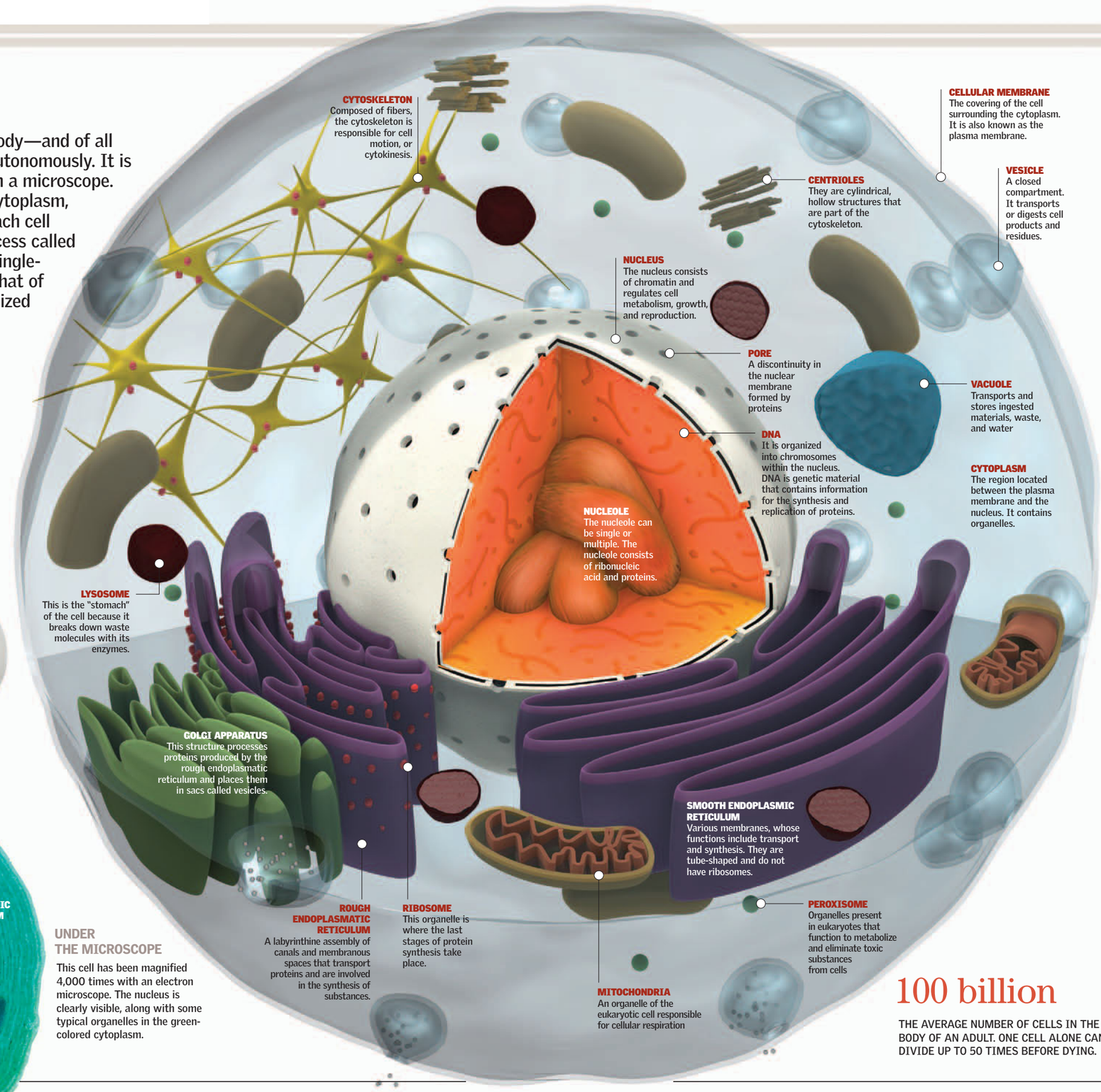
THEODOR SCHWANN

MATHIAS SCHLEIDEN



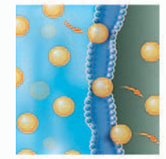
UNDER THE MICROSCOPE

This cell has been magnified 4,000 times with an electron microscope. The nucleus is clearly visible, along with some typical organelles in the green-colored cytoplasm.

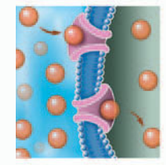


TRANSPORT MECHANISMS

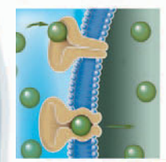
The cell membrane is a semipermeable barrier. The cell exchanges nutrients and waste between its cytoplasm and the extracellular medium via passive and active transport mechanisms.



DIFFUSION It is a passive transport mechanism in which the cell does not use energy. The particles that cross the cell membrane do so because of a concentration gradient. For example, water, oxygen, and carbon dioxide circulate by diffusion.



FACILITATED DIFFUSION Passive transport in which substances, typically ions (electrically charged particles), that because of their size could not otherwise penetrate the cell's bilayer can do so through a pore consisting of proteins. Glucose enters the cell in this way.



ACTIVE TRANSPORT It occurs by means of proteins and requires energy consumption by the cell because the direction of ion transport is against the concentration gradient. In some cells, such as neurons, the Na+/K+ pump uses active transport to move ions into or out of the cell.

Mitochondria

The mitochondria provide large amounts of energy to the cell. They contain a variety of enzymes that, together with oxygen, degrade products derived from glycolysis and carry out cellular respiration. The amount of energy obtained in this process is almost 20 times as great as that released by glycolysis in the cytoplasm. Mitochondria are very different from other organelles because they have a unique structure: an external membrane enclosing an internal membrane with a great number of folds that delimit the internal area, or mitochondrial matrix. In addition, the mitochondria have a circular chromosome similar to that of bacteria that allows the mitochondria to replicate. Cells that need a relatively large amount of energy have many mitochondria because the cells reproduce frequently.

100 billion

THE AVERAGE NUMBER OF CELLS IN THE BODY OF AN ADULT. ONE CELL ALONE CAN DIVIDE UP TO 50 TIMES BEFORE DYING.