of this extremely important inherent human characteristic (the IN), and in creating any form of information service, it is crucial to take into account the properties of the IN. The quality of these forms—for example, the quality of an information retrieval (IR) system—will be determined by how completely and effectively these forms account for the properties and characteristics of the IN during their service to the user. Hence, is important to understand the nature of a person's IN, as well as its properties and characteristics. This chapter deals with these issues.

2.2 The Individual as a Functioning System

To explain the role of an IN in a person's life, it is beneficial to consider the person first. A person is a complex biological system whose vital activity is carried out by its organically innate functioning algorithms for each of the processes of its subsystems. Moreover, the work of these algorithms in the complex is itself an algorithm of the vital activity satisfying the whole function of the entire system—the function of life.

A healthy system is biologically balanced and is in a comfort state. The mechanisms of homeostasis as parts of the vital activity algorithm are responsible for preserving this balance and for maintaining the system in the comfort state, that is, in that state under which the system most easily survives and fulfills its function.

Obviously life is not a prerogative of people. We are only an element of a system such as the biosphere. This concept designates all life on our planet. Who would think that systems such as a virus and a man could have anything in common? However, they are united by one property—they are living. They have algorithms of life: metabolism, reproduction, growth, motion, adaptability, mutability. The last two properties provide survivability of the individual and of the species. In living systems these algorithms are developed in such a way as to guarantee preservation of the species.

All life has a cell structure, and it is possible to trace some rising expediency of life from the simplest to the most complex, from the elementary (lower) level to a more complex (higher) level, and to trace the subordination of simple to complex, of lower to higher. Thus, the cell is subordinate to the organism, the organism to the species, and the species to the biosphere, subordinate in the sense that their life and death are justified as long as they are directed to the survival of a higher level. In a certain sense, cells play the same role for the organism as the organism plays for the species, and the species for the biosphere.

Algorithms of living creatures are divided into three types, depending on the goals they satisfy: those for oneself, those for the family, and those for the species. They do not always act harmoniously—in various periods of life this or

that one prevails. In addition, each element of the system in turn has its algorithms, which in principle can be classified by the same criteria: for a given part (for example, a cell), for a higher system (an organ), or for a still higher system (the organism). The inherent algorithms can be suppressed in the interests of the higher system. This situation exists, for example, in an organism where cell algorithms have different character, part of them working "for themselves," others for the organism. An organism's regulating systems, for example, suppress the excessive multiplication of cells for which every living system strives.

The memory that preserves the algorithms of a species of organisms is *deoxyribonucleic acid (DNA)*. Its molecules are located in the chromosomes of the nucleus of each biological cell. DNA reproduces itself precisely during cell division, which over a number of generations of cells and organisms guarantees the transfer of hereditary traits and specific forms of metabolism. The hereditary traits themselves are encoded in specific parts of the DNA molecules called *genes*. Each gene is responsible for the formation of some elementary trait. A unique property of genes is their combination of high stability (nonchangeability over a number of generations) with the capacity for inheritable changes, or *mutations*, which are sources of the genetic diversity of organisms and the basis for natural selection.

To understand the survival of a species, it is useful to consider one-celled creatures, such as microorganisms. Their structure consists of molecules of complex organic compounds, and their external function is represented by algorithms of multiplication and chemical actions on the surrounding environment. The possibility that a concrete system (organism) will survive is very limited, because both the perception of information about the external environment and the possibility of processing it in the system itself lie within rather narrow limits. For example, a microorganism does not know that it is located in a small reservoir that will soon dry up and thus entail its death. It also is not in any condition (it does not have the mechanism) to make a decision about moving over a still-existing isthmus to a reservoir that is not drying out. However, survival of the species is not in danger; it is maintained by a huge rate of reproduction (the loss of microorganisms in the dry reservoir is compensated in a nondry one very quickly) and by the very active changeability, mutations, whose results are realized through wide natural selection. It is important to mention here that molecules of DNA in one-celled organisms are less stable than they are in higher forms and they can change comparatively easily, which enables mutations and thus the survival of the species. K. Grobstein (1974) illustrated this point. A population of bacteria was placed near a hot spring. In the center of this spring the temperature was 80° C, and within a radius of about three meters the temperature gradually lowered to room temperature. The majority of bacteria can exist only at temperatures below 30° C. If some mutant organisms, which are less sensitive to elevated temperatures, are contained in the population, they can reproduce in the zone maintaining a temperature of 30° C. In the population