
Summary and Perspectives

Staying alive is something we do automatically. Health is usually taken for granted; ordinarily, we become aware of it only when something goes wrong, that is, when we experience signals of bodily malfunction, symptoms and signs of disease. While the nature of life itself remains a mystery, a great deal is known about the processes and mechanisms involved in living systems (Miller, 1978).

General systems theory proposes that the universe is composed of a hierarchy of concrete systems (Miller, 1978; Von Bertalanffy, 1968). These systems are accumulations of matter and energy organized into interacting, interrelated subsystems existing in a common space-time continuum. A patient is a *living system* composed, in turn, of biological subsystems. He is also part of a surrounding suprasystem (ecosystem). The living system is an *open system*; matter-energy and information pass back and forth and across the system. The general systems approach avoids the dichotomy between mind and matter. What have been called "mental" and psychological are conceptualized as manifestations of the information-processing subsystems, while what have been called "somatic" and physiological are conceptualized as manifestations of the matter-energy-processing subsystems of the living system. Of course, both systems are made of matter-energy. The health-care system is also an open system, into which patients enter, in which they are treated, and which they ultimately leave.

Living systems are amazingly complex. For example, an individual person in his life space can be thought of as a virtually infinite series of mutually interactive systems arranged in such a way that (1) one single system may function individually as a *unit* or as a part (subsystem) of a larger system (suprasystem); (2) there are two-way interactions between

and among adjacent and related unit systems and suprasystems and subsystems; in these transactions, both interactants are affected and changed; and (3) change in any unit or group of units eventually may affect functioning in all other parts of the aggregate. It's a good thing we do it automatically!

Each of us constitutes an individual or unit living system, existing in an environmental system. Both the individual person and the surrounding environment can be regarded as subsystems of a biopsychosocial suprasystem. Although energy and information can flow freely in both directions between the person and his environment, the person nonetheless maintains a separateness that is evidenced by the fact that the total energy level in the living person is higher than that of the surrounding environment (Schrodinger, 1962). This fact, in one sense, defines what it means biologically to be alive, that is, to maintain a dynamic equilibrium that sustains differential energy levels between the organism and the surrounding environment in an open energy system (negative entropy). When life ceases, the energy differential disappears.

Physical integrity of the living person is maintained by a series of interacting boundaries that begin at the interface between person and environment (e.g., skin, mucosal lining of body orifices, epithelial lining of lung, and sensory apparatus of the nervous system) and extend progressively deeper and deeper within the individual's interior and specialized subsystem (see Figure 37). Energy transactions with the physical components of the environment consist of a chainlike series of physicochemical reactions starting at or relatively near the surface of the body and extending inward all the way to intracellular processes.

Psychosocial integrity of the person is maintained by a series of articulations with the interpersonal and social environment. In this sphere, transactional exchanges of information or meaning are mediated by symbols, including language. Patterns of sensory stimuli that are conducted into the individual via the peripheral nerves or special sensory organs are processed by the brain into *meanings* against the background matrix of memory and other cognitive processes. These as yet poorly understood brain processes and functions are grouped together as belonging with the realm of the "mind" (psychological processes).

Emotions participate in both of the foregoing series of articulations—the energy transactions ("physiological") and the meaning transactions ("mental"). Thus, emotions bridge the physical and symbolic aspects of environment with the physiological and mental aspects of the person.

The famous French physiologist Claude Bernard pointed out that the internal environment of the body must be maintained in a constant, steady state for optimal life processes to occur. The myriad elaborate

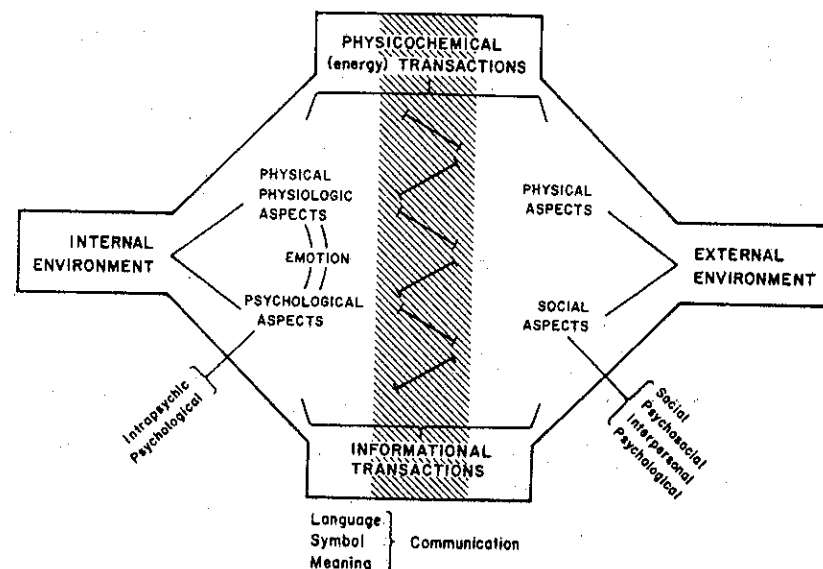


Figure 37. Interacting boundaries between the person and the environment.

and intricate chemical and physiological regulatory mechanisms that are involved in stabilizing the *milieu intérieur* are referred to collectively as *homeostasis*, a term coined by the American physiologist Walter Cannon (1932). The collective functioning of dynamic physiological processes that maintain the constant internal environment (which supports health and the accompanying sense of well-being that we take so much for granted) in the face of challenging inconstancy of the external environment is called *adaptation*. *Health* can be regarded as a state of *successful and effective adaptation* and *illness* as *maladaptation*. Adaptation to both physical and psychosocial aspects of the environment encompasses transactions between the person and the environment and among the components within the person. The latter may serve either or both of two purposes: (1) to maintain internal constancy despite environmental challenge; (2) to initiate and implement action that would change or accommodate the environment. All this is integrated, coordinated, and mediated by the nervous system and the neuroendocrine apparatus. Psychological and social challenges in the environment are perceived, evaluated, and reacted to by the organism through the multiple operations of the brain, which we call by the collective term "mind."

So, with respect to both the physical and psychosocial dimensions of the environment, we can see that the brain serves as the control center for physiological and psychological mechanisms. The environment, the person as a unit, and the components of the person are, so to speak, connected by and in the brain, which serves to regulate the person's physiological and behavioral adaptation to environmental challenge.

Environmental challenges can be thought of as *stresses* that create a demand for adaptive work on the part of the organism; they may be physical or symbolic in nature. Their detection and processing as well as the ultimate responses to them in the form of internal readjustments or behavioral output into the environment are mediated by neural and endocrine structures. The extent and vigor of response reflect the *strain* that was created within the organism in reaction to stress. Some of these responses are primarily physical or physiological, for example, regulation of the pH of the blood; others are primarily psychological, for example, writing poetry. There is also a vast spectrum of life processes that express themselves (and are mediated) in both the physiological and the psychological spheres. The most prominent of these, of course, are the emotions.

The intriguing "intimate-but-separate" nature of the relationships between the inside and outside of living systems has stimulated interesting philosophical reflections about reciprocating influences of each on the other in evolution and development. In his essays, Lewis Thomas (1974) discusses in a highly imaginative and stimulating way some implications of resemblances between the cytochemistry of cells and the oceanic saline environment in which living matter had its origin. For example, he speculates that the mitochondria in our cells might be the descendants of some primitive bacteria that entered the primordial cells eons ago and stayed there in a symbiotic relationship with the cells. On the other hand, the advent of photosynthetic cells changed the course of evolution of the earth through the production of oxygen, which in turn determined the course of evolution of living systems on earth. He also finds striking similarities between the single cell and the earth as an entity.

Similar analogies can be and have been drawn between the nature of social structures and institutions on the one hand and some aspects of personality structure on the other, for example, those based on similarities between (external) moral and ethical standards of behavior as reflected in law and religion and internal psychological "structures" such as conscience (*superego*) and the emotion of guilt. It may not be too farfetched to speculate that these internal and external analogues evolved from an interactive process, that is, psychological processes influencing

and shaping developing social conventions and in turn being influenced and shaped by society. Some students of semiotics postulate similar reciprocal relationships between structural characteristics of the central nervous system and structures of the environment that determine patterns of sensory input. Noam Chomsky (1978), a linguist, postulates that meanings as expressed in language are dependent on functional substructures inherent in the organizational nature of the central nervous system. All these ideas do seem to converge in suggesting a mutually interactive developmental lineage between the inside and the outside of living organisms.

To summarize, a person is comprised of, and is a part of, a virtually infinite series of systems and subsystems. These systems and subsystems can be broadly grouped into two organizations—the person and the environment. The *physical environment* includes terrain, climate, fauna, flora, and environmental toxins. The *social environment* consists of significant individuals, families, small groups, communities, cities, states, and nations, all embedded in and influenced by a variety of cultures and subcultures—present and past.

The person can be viewed as subdivisible into organ systems, individual organs, cells, and intracellular subsystems. The *meaning system*, a function of the brain, defines the person's psychosocial integrity. Transactions or changes in any part of the personal system ultimately can be expected to affect all other parts of the system. For example, a change in the salt content of drinking water in the environment will ultimately affect hormones regulating electrolyte and fluid balance, function of cells in the kidney, function of the cardiovascular-renal system, and, finally, thirst and water-seeking behavior.

All the systems we have discussed exist in *time* as well as in space. The environment and the person have a past, present, and future. Progress through time is a continuing evolutionary process. At any given moment, the systems express what has gone before, and what transpires in the present will affect the state of the systems in the future. To understand the current state (including maladaptation) of any of these systems, knowledge of the past is helpful and often necessary. People undergo continuing development and maturation. The life cycle, the process of individuals' change over time, can be divided into phases, each of which has its unique adaptive tasks (Erikson, 1963; Levinson *et al.*, 1978). At any given time, the person exhibits remnants of past patterns of function as well as current patterns that have been built on the older ones that have been modified in the course of development—a process called epigenetic development. To understand the environmental past, we turn to history, geology, archaeology, and cultural anthropology. To understand

the person's past, we look to his or her genetic endowment and developmental life history, that is, a review of life experiences and their impact on developmental processes and maturation. This historical perspective has relevance in clinical diagnosis—the current or immediate state of balance between pathogenic vectors and the resistance of the individual to the pathogenic challenge will reflect and be influenced by what has transpired before in relevant subsystems. This is the reason that the medical history starts with the current chief complaint and proceeds to the history of the present illness (a chronicle of developing symptoms and signs) and, from there, to past medical history, review of systems, and family history. In this volume, we have expanded this theme to propose a clinical diagnostic method for tracing biological, personal, and environmental dimensions in terms of the present, the recent past, and the distant past (background).

States of adaptation or maladaptation (health or disease) have biological, psychological, and social aspects, and to be fully understood, they must be described with respect to all three systems: (1) the biological system, (2) the personal (psychological) system, and (3) the environmental system.

Keeping all this in mind, review what actually occurs in a routine medical encounter, for example, the first time a patient and physician meet in the consulting room. Each constitutes a biopsychosocial system. When the two come together, a therapeutic doctor-patient relationship is established, and around this dyadic relationship a whole series of subsystems forms and evolves in support of the care of the patient. This new complex system will include individuals and groups who are significant members of both the patient's and the physician's psychosocial spheres. This means family and friends of the patient and the myriad individuals and organizations drawn from the health-care system, including other physicians, nurses, social workers, and allied professionals (e.g., physical therapists, aides). The interactions will occur in clinics, offices, hospitals, wards, and special treatment units in the hospital and will require activities of administrative and financial organizations such as hospital administration, health plans, insurance, and government subsidiaries. Since transactions at all interfaces affect all parts of the system, the physician will have to deal with relevant biological, psychological, and social vectors as he carries out his job. Because of this, the behavioral sciences provide important and critical facts and concepts that are basic and necessary for satisfactory understanding and management of these complexities of medical practice. It has been our goal in this volume to introduce and sensitize the readers to what we think may be the most immediately relevant information from the behavioral sciences and to

show how it may be integrated with relevant biological and physiological principles in understanding health, disease, and clinical practice. Of course, such a goal cannot be fully achieved in an introductory textbook. We hope that we have stimulated the readers' thoughts, whetted their appetites, and started them on the road toward developing their own approaches.

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