Some Aspects of Sciences from the Biophysical Point of View

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Abstract: The science, this some three thousand year old form of human activity took significant growth in the last 300 years and has confronted with all those difficulties which are quasi inevitable concomitants of all new formation. The three-dimensional model contains five main layers: the inorganic (inorganic systems), the organic, the social, the intellectual and the spiritual. We discuss the hierarchy of the systems according to Boulding. After we indicate some classifications of the sciences. Biophysics is searching for, dealing of and teaching the forms of the connections between the inanimate nature, the living world and the spiritual life, the applicability limits of their own laws in the other medium, their common mutual interactions. To get hold of the biophysical view is not an easy task, because it applies mathematical apparatus to biological systems, on the other hand as a reward it guides to fascinating results, recognizing theoretically which conformity of rules are valid on principle in the Universe in the inanimate-living-spiritual triple system from the lowest to the highest organizational level. Interdisciplinarity oversteps the narrow bounds of the divisions of science and there appear models more manifold reflecting the complex systems. In this way one can make up the reader's claim to consider systematically those problems arising from the various fields of science and life in the countless variety of interrelations and in their very different consequences

Key words: sciences, hierarchy of the systems, borderland sciences, biophysics, interdisciplinarity

Introduction

It is the anthropocentric and geocentric way which has been, is and shall be characterizing the human activity, the general human way of thinking, the aim of life and the human spiritual life in every time and under every circumstances. If in the near future it will occur that crowds of human beings can emigrate in the space, then a superior human variant may come into existence. The four-milliard' global life and the spiritual activity of man has taken place in the continuous gravitational field of the Earth so being developed into its today's form and in this will occur a qualitative leap, because the alternating gravitational field will react upon and transform the processional schemes of the triplet inner-mechanisms of nature-living-soul and will also change the equilibration's and also the extreme values of its limits.

The science, this some three thousand year old form of human activity took significant growth in the last 300 years and has confronted with all those difficulties which are quasi inevitable concomitants of all new formation. [1] Nowadays, when the objective conditions of the scientific development are mostly given, there are rather subjective factors to protract progress, among them of distinguished high priority: the hand-steering type activity of the leading personalities, the unscientific character of the decisions, the bureaucratic structure of the institutional systems of municipal services the fetishism of money, the looting nature of man the scientific search subordinated to economy, social corruption, human behavioral forms based on lies, the restraint from the unknown, avoidance of the shock-like impact of novelty.

The Three-Dimensional Model of Sciences

It is clear that the classification of sciences, based on the forms of motion, contains a number of contradictions. The following three-dimensional model goes one step further by taking into account both the forms of motion and the overlapping levels of existing systems. According to this idea, the real world has a layered structure. It contains five main layers: the inorganic (inorganic systems), the organic, the social, the intellectual and the spiritual. [2] The specific nature of each layer is formed by the principles and categories that prevail in it, which are basic statements and definitions of the existing as existing, and not merely intellectual concepts or statements.

The first layer includes disciplines dealing with knowledge that put inanimate systems at the center of their research: mathematics, physics, chemistry, geology, geography, astronomy, etc.

The second layer includes the disciplines dealing with living systems: biology, medicine, agronomy, sports, etc.

The third layer includes the social sciences: history, philosophy, economics, technical sciences, sociology, law, etc.

The fourth layer includes the disciplines and knowledge of intellectual activities: linguistics, literature, poetry, language skills, logic, etc.

The fifth layer is the repository of our knowledge of spiritual phenomena: psychology, ethics, religion, arts, etc.

Categorical laws can be of the horizontal type when they connect areas within the same layer, and vertical when they create connections between different layers. [3] The interdependence and independence of the individual layers is determined by the so-called "Dependence laws". The first law of dependence is the law of "force": categorical dependence exists only from the lower to the higher layer, there is no dependence relationship the other way. The lower layers are thus determinatively stronger, but the strength and height of the layers are inversely related to each other. This means that it may make sense to explore physical laws and their limits of applicability in biological systems, but at the same time to study the applicability of biological laws in physical systems may be unreasonable. The second law of dependence is "width", which states that the lower layers are more numerous than the higher layers, and the higher layers may include, but are not limited to, certain systems of the lower layers. The third law is the law of "structuring", which states that the internal structure of systems in the higher layers is more complex than the internal structure of the lower layers.

The hierarchy of the systems

The approximations of the investigations between the branches of science by interdisciplinary attitude clearly show the increasing interest for joining the knowledge into systems of wide spectra. If we don't want the research between the branches of science to lead into limitlessness then we have to elaborate systems for the integration of the independent branches within which they can still maintain their distinctive character. [4]

The hierarchy of the systems will be built up according to a spiral line expanding in breadth and depth towards the infinity. Although the idea of the system and the necessity of building-up systems is not new-fangled (updated), systems were not enough stressed in the sciences for a long time. [4] Though as a result of the significant discoveries at the beginning of our century, a break-through has been achieved both in the field of physics and of mathematics, yet these were the last decades when the interdisciplinary attitude came across also in the biology. But in addition there was a considerable contribution by the rapid development of other sciences like mathematics, physics, chemistry, technical sciences because their discoveries, methodologies and tools gave way for the biologists to probe deeply enough into the recognition of the living material. At the same time, the results of the sciences penetrated stimulating and inspiring the biology in the form of analogy and terminology. [5]

One important mode to construct general systems is if we recognize the common phenomena occurring in the different specialized sciences and construct the systems applicable for such phenomena. The second construction mode would be to arrange the systems in a hierarchic system. This in the same time would result in fixing the abstraction levels corresponding to the different degrees. This cannot be realized unequivocally. [6] The second construction mode, the hierarchy of the levels will be investigated in details.

Generally speaking the different levels cannot be delimited unambiguously and it is the investigator to separate them artificially due to methodological reasons. Systems are not divided into sub-, super- and coordinated relations, respectively, in a well determined manner but they appear intermixed in the structural hierarchy. Let's sketch out the hierarchy of the systems according to Boulding as follows. [7]

1.) The first level is that of the static structure. It could be called the level of the shells (skeletons). It is really the geography and anatomy of the universe: the localization scheme of the electrons around the nucleus, the scheme of the atoms in a molecular formula, the settlement of the atoms in a crystal, the anatomy of the gene, the cell, the plant, the animal, the map of the Earth, the solar system, the stellar world. The organized theoretical knowledge starts with the exact description of these shells on almost every territory because no functional or dynamic theory can exist without this accurate description of the static conditions.

2.) On the second level you can see the simple dynamic system with its predetermined, necessary movements. It could have been called the level of the clockworks. From the human point of view, of course, it is the solar system as the great clock of the universe and the imposingly accurate predictions of the astronomers to bear witness to the excellent quality of the clockwork applied. Mechanical powers can be usually interpreted on this level, like the lever and the pulley but also more complicated machines like the steam-engine and the dynamo (generator). To the same level belongs the physics, chemistry and even the major part of the theoretical constructions of the economy, too.

3.) The next level is the steering mechanism or cybernetic system which could be otherwise called the thermostat level. This differs from the simple stationary equilibrium system in that its substantial part is the transmission and processing of the information. [8] The equilibrium, therefore, will not be simply determined by the equations of the

system but the system itself seeks to maintain - within limits - a certain equilibrium. The greatly important homeostatic model in the physiology is only one example for the cybernetic mechanism but the whole world investigated by the biologist and sociologist is full of such mechanisms.

4.) The fourth level is the „open system” or the self-sustaining structure. On this level the living begins to separate from that which is not living: this could be called the level of the cell. If we fall in with systems being able to reproduce and sustain themselves during matter- and energy-perfusion then we have to deal with something of the kind which we hardly can deny the name „life”.

5.) The fifth is the level of the genetic society the typical form of it rules over the flora and the empirical world of the botany. The major characteristics of this system are first the cell population formed by division of labor between the cells with its differentiated and mutually interrelated parts (roots, leaves, seeds, etc.), secondly a sharp separation between genotyp and phenotyp which is related to the one-aimed or programmed growth.

6.) Going upwards from the flora to the fauna gradually we reach the „animal” level which is characterized by motility, specific behaviour and by self-identification. Here special information-receivers are developing (like eye, ear, etc.) and as a result, the information-uptake grows enormously. [9] In addition, the nervous system increasingly develops, after all the brain as the organ which organizes the information into structural knowledge or „image”. Going upwards on the scale of the animal life, the behaviour becomes not only a reaction to any concrete stimulus in an ever raising degree but an answer to an „image” or structured knowledge or attitude formed from the environment as a whole. This image will lastly be determined, of course, by the information taken up by the organism, however, the relation between information-uptake and imaging (the construction of a picture) is extremely complicated. The process is not simply the accumulation of the accepted information - although it is often the case - but it will be structured in a manner which essentially differs from the information itself. Once the image-structure has been definitely formed the new information will hardly change on the picture: it quasi passes the loose structure without „colliding” with whatever. [10] The image sometimes „catches” the information incorporating it, sometimes the information comes into collision with any core, „nucleus” of the image so that its whole will be transformed in a way that a seemingly inconsiderable stimulus will provoke a highly significant reaction, that is to say, the behaviour will change considerably and radically. Thus the determination of the future behaviour of such systems will be aggravated, namely by the picture intercalated between the stimulus and the answer.

7.) Follows the „human” level, that is the individual human being comprehended as a system. Man is probably the only organism which knows that he will die, which takes into account - by forming his behaviour - his full lifespan and even more of it. [11] Man exists not only in a given time and space but in history, too, and his behaviour will be deeply influenced how he sees the course of time he lives in.

8.) The social level. The fundamental level of such systems is not even the individual - the human being as such - but the „role” that is those circumstances of the personality which are in relation with the organism or situation in question. What should be investigated on this level? The content and meaning of the informations, the nature and dimensions of the scales of values, the transcription of images into history, the embarrassing and delicate symbolics of the fine arts, music, poetry.

9.) In order to complete the hierarchy of the systems still we have to include the level of the psychical systems, too. There are also other aspects to classify our environmental world. Below, you will find some other hierarchies of the systems. Such kind of representation of this hierarchy has, among others, the advantage that it offers some idea about the shortcomings of our present - theoretical as well as practical - knowledge.

Some classifications of the sciences

Matter is known to exist of two fundamental kind: that of discrete nature, of corpuscular structure and those physical domains/fields displaying steady feature and transmitting interactions between material parts. The particles of corpuscular character and the physical domains can not be sharply separated from each other, there is no impassable barrier between the two outward forms of the matter, they can transform in each other. Under certain circumstances, these outward forms of the matter posses similar features, corpuscula generate spaces of different type, display continuous wave character, on the other hand, domains may have manifestations characteristic of particles.

The material systems are in steady movement, motion is inseparable from the matter. [12] The motion is the mode of existence of the matter and accordingly, on the basis of the structural units of the material world and of the types of movements we can set up the hierarchy of systems as follows:

- mechanical movement
- subatomic movement
- the movement of the radiating material
- the movement of the electron in the atoms and molecules
- chemical movement
- molecular interactions

- thermal movement
- the movement of cosmic objects
- geological movement
- biological movement
- thinking, psychical movement
- social movement.

The matter of corpuscular structure can be divided in number of structural levels - depending on its organizational grade and composition. For example:

For the human eyes, the lower limit of the sharp sight is around 10^{-4} m. In the beginning, elements below this level have formed the microworld, those possessing higher linear measure formed the macroworld. Later on the mesoworld became wedged in between, which comprises the order of magnitude of those terrestrial living creatures visible by the human eye. The longest-barked trees and the longest sea-algae are of 100 m of order. [13] As a result of the technical development, both the micro- and macro measures have divided in two domains:

- less than 10^{-9} m submicroscopic level
- between 10^{-9} – 10^{-4} m level of the microscopic system
- between 10^{-4} – 10^2 m level of the mesosystem
- between 10^2 – 10^9 level of the macrosystem
- larger than 10^9 m level of the megasystem.

Another possible hierarchy of the systems can be based upon their structure [14] (evidently according to our present knowledge):

- the level of quarks
- the level of elementary particles
- the atomic level
- the molecular level
- the macromolecular level
- the colloidal level
- the crystalline level
- the level of states: solid, liquid, gaseous
- the level of mainlands, seas, atmosphere
- the level of the planets and stars
- the level of the solar and stellar systems
- the level of the galaxies
- the level of the metagalaxies
- the level of the universe.

As far as the classification of the biosphere is concerned, a great number of system-hierarchies can be set up. Just to mention but a few:

- plants, animals
- unicellulars, multicellulars
- procaryots, eucaryots
- aerobic, anaerobic organisms.

With respect to the man, let's set up the hierarchy of his living subsystems according to the structural construction of the biology [15]:

- macromolecular level (DNA, RNA)
- the level of cellular organelles (receptors, nucleus, membranes)
- cellular level
- the level of tissues (epidermic, connective, muscular, nervous)
- the level of organs
- the level of organ systems and apparatuses
- the integral human level.

The four essential features of living systems are, in short, the set of content components, structural construction, communication, and intermittent parameters that implement the functions. (Table. 1.)

Table 1. A possible classification of systems

Aspect	Version
Task	Best-first search Regulation
Functioning mode	Discontinuous Continuous
Behavior over time	Constant Varying
Property of signs	Deterministic Stochastic
Character	Linear Non-linear
Internal structure	Constant Adaptive Learning Self-guided

It has to be emphasized again that limits between the different levels of systems become indistinct whichever hierarchy is concerned.

The borderland sciences

The different areas are not closed and related problems are examined in a number of classical fields. This is what interdisciplinary fields were developed for, which can make a connection horizontally, at the level of the same layer, such as: physical chemistry (first layer), phytopathology (second layer), or vertically between different layers such as: biomathematics and biochemistry (between the first and second layers), mathematics linguistics (between the first and fourth layers), social psychology (between the third and fifth layers), etc. [16] The boundaries of different scientific branches could be considered as starting points of many facets of new initiatives for collaboration. Today, they are several hundreds of interdisciplinary fields.

But interdisciplinary fields can also emerge between several layers, such as biophysics, which connects the first, second, and fifth layers. The biophysics in mentality and technique is a synthesis of physics, psychology, and biology. In reaching a right result, the biophysics is employing the investigation methods of the mathematics. The main goal of the biophysical cognition as that of a borderland science is to reveal and cautiously draw up the laws guiding the motion and development of phenomena. [17] The phenomena investigated by the biophysics are in steady fluctuation, nothing of the sort unambiguous causal relations can be determined because their origin and manifestations are based on non-linear causal connection.

In biophysics, the objectivity of a theory will be esteemed according to the followings: the measure of the effect and intervention to the phenomenon under study, the measure of drafting and expressivity; the level of usefulness. Every biophysical experiment bears the personal intuition of the researcher and especially in the interpretation the mark of the individual prejudice (one-sidedness), inventiveness. The reason stated by the biophysicist must mean an advance somewhere to answer of one scientific question otherwise the statement won't disclose any information. [18]

Biophysics as an immense spectrum comprehended by one of the most commonly applied borderland mental process embracing from the nature, through living systems up to spiritual processes brings it along inevitable that the reader will join issue here and there with the deductions of this book but in actual fact it was just one of the goals of this work.

To get hold of the biophysical view is not an easy task, because it applies mathematical apparatus to biological systems, on the other hand as a reward it guides to fascinating results, recognizing theoretically which conformity of rules are valid on principle in the Universe in the inanimate-living-spiritual triple system from the lowest to the highest organizational level. In this way one can make up the reader's claim to consider systematically those problems arising from the various fields of science and life in the countless variety of interrelations and in their very different consequences. [19]

Biophysical modeling is a method that can be used to study biological mechanisms – that is, it involves mathematical analysis and model systems. The models serve as analogues of operation and regulation, based on information signals specific to the living organism, and thus monitor their mechanism of operation until different automatic regulations of the normal state and different, that is deregulated functions and complexity. [20]

Interdisciplinarity

Interdisciplines are necessarily irregular for they have to prove that one was mistaken in the classic sciences, came up against difficulties; thing ones considered true is no more veritable. The interdisciplinary attitude in this sense is a kind of revolt.

Interdisciplinarity: an attitude (outlook) upon life traversing all disciplines which can particularly used by any discipline on the basis of its own generalized proper axiomatics. Interdisciplinarity oversteps the narrow bounds of the divisions of science and there appear models more manifold reflecting the complex systems. [21]

The interdisciplinary view terminates the isolation of the specialized and border branches of science, because by enabling general statements it encourages the creator working in the above mentioned fields to overlook deeper and more extensively wider his investigated topic.

Forming of an interdisciplinary attitude means not only the recognition of the relationships but also the forming of such a way of seeing which creates connectron with conceptual spheres, recognised in the different branches of science of similar terminology but often different by content and generally never synthetized.

Accordingly, the forming of the interdisciplinary way of looking is possible only if we investigate the natural phenomena in their interconnections because the explanation necessitates survey for fewer knowledge of fundamental low.

The systematizing principia imply the aim of teaching interdisciplines and for specialists improved an this basis the change of the environment is a natural process which shouldn't mean the obsolescence of their knowledge but requires making the collection of examples material up-to-date.

The three-dimensional model of sciences points to the organic unity of the world, and which is more perfect in its uniformity and consistency than anything previously drawn. This model documents that the movement system of the material and spiritual worlds forms a unity, and that, without the knowledge of the realities, human literacy becomes unfounded, and vice versa.

References

- [1] Vincze, J.: Medical Biophysics. NDP P., Budapest, 2018.
- [2] Vincze, J. Vincze-Tiszay, G.: The Biophysical Modeling of the different Regulations in the Human Organism. Intern. J. Inovat. Studies Med. Sciences, 2020; 4(1):1–4.
- [3] Vincze, J.: The Biophysics of the Human Apparatuses. NDP P., Budapest, 2020.
- [4] Bertalanffy, Ludwig von: General System Theory – Foundations, Development, Applications; Revised edition, George Braziller, New York, 1968.
- [5] Narayanan, P.: Essentials of Biophysics. New Age Publ., 2000.
- [6] Donskoi, D., D.: Grundlagen der Biomechanik. Sportverlag, Berlin, 1975.
- [7] Boulding, K. E.: General systems theory – the skeleton of science. Management Science. 1956; 2(3): 197–208.
- [8] Bialekm W.: Biophysics: Searching for Principles. Princeton Univ., 2011.
- [9] Dillon, P., F.: Biophysics: A Physiological Approach. Michigan State Univ., 2012.
- [10] Glaser, R.: Biophysics - an Introduction. Springer P., 2000.
- [11] Vincze, J., Vincze-Tiszay, G.: The “hypothetical secondary brain”, Medical Research Archives. 2019; 7(7):1–3.
- [12] Vincze J., Vincze-Tiszay, G.: The Biophysical Modeling of the „Seven-Dimensional” Man. Int. J. Recent Sci. Res., 2020; 5(6):123–130.
- [13] Vincze, J. : Interdisciplinarity, NDP P., Budapest, 2007.
- [14] Marshall, A. G.: Biophysical Chemistry: Principles, Techniques and Applications. John Wiley and Sons. 1978.
- [15] Serdyuk, I., N., Zaccai, N. R., Zaccai, G.: Methods in Molecular Biophysics: Structure, Dynamics, Function. Cambridge Univ. P., 2007.
- [16] Vincze, J.: The Biophysics is a Boderland Science. Second Ed. NDP P., Budapest, 2015.
- [17] Vincze, J., Vincze-Tiszay, G.: The Biophysics is a Borderland Science. Roum. J. Appl. Scien. Tech. 2020, (2)3:115–121.
- [18] Vincze, J., Vincze-Tiszay, G.: The Biophysical Modeling of the Biopsychological System. J. Progressive Research Social Sciences 2020; 9(3):733–738.
- [19] Vincze J., Vincze-Tiszay, G.: The Biophysical Adjustment in the Human Organism. J. Med. Res. Case Report, 2020; 2(3)1–7.
- [20] Vincze, J.: The Biophysical Modeling of the Apparatuses in the Human Organism. Lambert Academic Publishing, Berlin. (2020).
- [21] Vincze, J.: Interdisciplinarity, NDP P., Budapest, 2007.