

Some Stress Aspects from Psycho-biophysical Point of View

Janos Vincze, Gabriella Vincze-Tiszay

Health Human International Environment Foundation,
Budapest, Hungary

*Corresponding author

Janos Vincze, Gabriella Vincze-Tiszay, Health Human International Environment Foundation, Budapest, Hungary.

Submitted: 09 Oct 2020; Accepted: 14 Oct 2020; Published: 26 Oct 2020

Abstract

Selye published his famous theory of the stress in Nature in 1936. For the stress motto is the inscription at the main entrance of the Institute of Experimental Medicine and Surgery (Montreal): "Neither the prestige of your subject, and the power of your instruments, nor the extent of your learnedness and the precision of your planning, can substitute for the originality of your approach and the keenness of your observation." The stress in the human organism is a perturbation. This perturbation is regulated by negative feedback. All physiological parameters characterizing the organism oscillate between a minimum and maximum value. The stress is properly a general adaptational answer raised under the influence of some stressor, with characteristic but not specific changes. The organism can, in general, get along namely by switching on also another regulatory mechanism for the convenient control of the altered physiological parameter. All these surplus regulations need excess-energy from the side of the organism, contribute to wear it and for this very reason accelerate the process, of aging. We use the Le-Chatelier principle and determine the measure of psychical organization. For the all laboratorial parameters exists five zones: optimum (1), admissible (2a., 2b.), dangerous (3a., 3b.), inactivity (4a., 4b.) and inviability (5a., 5b.). As a conclusion, the present medical science reserves the word perinormal for naming biophysical, biochemical and physiological responses in a wide range that warn us referring to the existence of mainly quantitative or reversible qualitative changes and the possibility of irreversibly pathological qualitative alterations. We presented of the biophysical modeling of the creativity and talk over the psychological balance of the man.

Key words: Stress, Biophysical Modeling, Laboratorial Parameters, Le-Chatelier Principle, Psychological Balance

Introduction

In the living organisms stress can be provoked on three levels: on biological, mental and psychical level. We speak of biological level if a physiological parameter gives an overdimensionated answer to the outer or inner stimulus; e.g. consume a rotten food, contact with an overheated object, effect of a very loud noise, inhalation of spoiled air etc. We speak about mental stress in general during processes bound to learning, acquiring like memorizing, recall, proficiency in speech, be in an examination funk etc [1]. Psychical stress can happen due to impressions related to the (human) personality: sorrow because of the death of a family member, break up the pair relationship, grave stander, uncertainty of existence etc. In man one hardly can rail off sharp limit between these three levels of the stress because the one can influence also the other (second, third) levels and so e.g. it is well known that the long-lasting psychical stress results in biological structural changes.

The Biophysical Modeling

The three-dimensional model goes one step further by taking into account both the forms of motion and the overlapping levels of existing systems. It contains five main layers: the inorganic (inorganic systems), the organic, the social, the intellectual and the spiritual [2].

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

ry of our knowledge of spiritual phenomena: psychology, ethics, religion, arts, etc. The biophysics in mentality and technique is a synthesis of physics, psychology, and biology.

With biophysical modelling, We usually understand the reproduction of the behaviour of a system on an analogue one especially built on the basis of certain rules [3]. Usually, the system is modelled either on a physical one, either on a mathematical one. Generally, for the study mode of the biophysical systems, two methods are foreseen: the phenomenological methods and static methods. The phenomenological method studies the phenomena regarding a few fundamental principles that result from various experiences, leaving aside the discreet internal structure of the matter.

The modeling method in biophysics consists of the creation of certain devices (models), with which processes analogue with those happening in living organism are studied. The biophysical model though abstract reasoning leads to models of the phenomena which by simplifying and isolating some aspects of the phenomena discover laws and relationships which describe with a certain approximation the behaviour or functioning of bodies or biological ensembles [4].

The biophysical models offer a language” of quantitative and qualitative processing of experimental data, being compatible and adequate to the laws of biology. The psychical system in organizational viewpoint is of developing character because it forms and develops within the frame of interaction between the man and his environment. It is, therefore, a self-organizing, developing system [5].

The organization of the psychical system is subordinated to the domination areas of the universal laws of the evolution and it is directed also by such particular principles which accentuate more concrete its organizational mechanisms and variants. Out of these let’s mention some: the Le-Chatelier principle, the weakest chain-loop, the efficiency of the energy consumption, the ranking, avalanche-effect, the compensation, the principle of action. In reference to the Le-Chatelier principle: if on a system in rest is operative such an external input which changes one of the conditions resulting the equilibrium state then the system evades in the direction reducing the outcome of the effect [6, 7].

The principle of the weakest chain-link declares that during a change-over from a given organization to the new one the modification determined by the effect of the directing factors take place mainly in the vulnerable points or chain-loops of the system. For the energy consumption an excellent example is the formation of dynamic stereotypes. Creativity can be considered as the highest level of the expression of the operational polyvalency of the human psyche [8]. The distance between reality and model the effort and the possibility is such an indicator which determines the real selfimplementation level of the personality. Since these indicators determine the entity of the psychical organization by their help one can estimate the general development level of the personality which expresses the conformity of the behaviour towards the nature and sense of the external effects [9]. This can be estimated by completing the phase profile of the psychical system on the basis of the main psychical indicators which can be expressed in the form of the following relation:

$$S = \frac{\sum_{j=1}^m Y_j(t_k)}{\sum_{i=1}^n X_i(t_k)} ; k=1,2,\dots,p$$

where $\sum_{j=1}^m Y_j(t_k)$ expresses the sum of the mean (value) of the adaptive answer answers, $\sum_{i=1}^n X_i(t_k)$

still the sum of their external effects and employments, tk ($k = 1, 2, \dots, p$) the consecutive moments of the examined period. If the value of S is near the zero then the personality is characterized by considerable absence of psychical organization, i.e. psychical inorganization; if the value of S is near the 1 it can be expected the individual should properly respond, show psychically balanced state and his psychical amplitudes should be minimal.

About the laboratorial (biophysical) parameters

The living organism is in a dynamic balance in normal homeostasis and any biological parameter oscillates around a characteristic mathematical average value (\bar{x}). This permanent oscillation, the timely change of the parameter is realized by the system based on the mechanism of negative feedback [9]. We give five level (Table I.)

1. The range in which the values of a certain biological parameter (x) exist is called optimal range (O). It is evident that in this range the respective parameter has inferior (Oxi) and superior (Oxs) limit values.

2a. and 2b. A certain biological parameter (x) can exit from the optimal zone due to an unexpected interior or exterior stimulus effect and enters the so called permissible range (M), in which it also has inferior (Mxi) and superior (Mxs) limit values. In case of this range living systems are characterized by a specific feature as the values of biological parameters show greater change towards major values than towards minor values. Thus, the following correspondence rules: $Mxs-Oxs > Oxi-Mxi$. Remark: this correspondence is valid only for all the parameters of living systems.

This is an extremely important remark as it follows that the negative feedback as regulation allows major values to prevail more powerfully than minor values. Consequently, in case of the permissible range the negative feedback in living systems happens in the direction of the most frequent parameter value, the modus (Mo) instead of the mathematical average value. If it happened in the direction of the mathematical average value, then it would be possible due to the range asymmetry that the mathematical average value were beyond the optimal zone and regulation would not be acceptable for the system. This zone is characterized by negative reverse condition. The American hypertension recommendation issued in 2017 changed the definition and treatment of hypertension the new limit is 130/80 mmHg.

3a. and 3b. If the parameter value, due to a certain effect, is off the permissible range, it would enter the so called dangerous range (P) and this range also has inferior (Vxi) and superior (Vxs) limit values. It is characteristic for the dangerous range, as well that major values change more powerfully than minor values: $Vxs-Mxs > Mxi-Vxi$.

In this range the system is not capable any longer to maintain the expected level of parameter value with classical asymmetric regulation needing „help”. Thus, another regulating mechanism of the biological system is activated to push the parameter value in this case in the modus direction. The long-term existence of any biological parameter in the dangerous zone creates stress state for the living organism. This is the stress state of biological systems. This zone is characterized by negative reverse condition. Many elderly person (chronic illness) very frequently are in this zone. The American hypertension recommendation issued in 2017 changed the definition and treatment of hypertension, the second limit is 140/90 mmHg.

4a. and 4b. If the parameter value gets out of the dangerous range due a certain effect, then it enters the so called non-functional range (F) and this range also has inferior (Fxi) and superior (Fxs) limit values and in this case follows $Fxs - Vxs > Vxi - Fxi$. In this respect, the biological system is not capable to regulate parameter value on its own and the system can be saved only through intervention coming from the exterior. This is the pathological state of biological systems. This zone is characterized by positive reverse

condition. In this zone for inhabitant often is necessary transplant the organ.

5a. and 5b. In case the parameter value gets out of the non-functional state, it enters the so called non-viable range (S) and this range also has inferior (Sxi) and superior (Sxs) limit values. In this respect, the biological system is not capable to regulate parameter value on its own and the system can be saved only through urgent intervention coming from the exterior. This is the dying state of biological systems.

The state of the biological system characterized by normal homeostasis is called healthy state. Formerly, the pathological state of living organisms was debated. Based on Selye’s experiments, a transitional state, the stressed state is also known [10]. Let’s examine the states of the living system based on the biological parameter ranges (see the table below.) The states of living systems can be classified according to the characteristic biological (biophysical, biochemical, physiological) parameters: healthy, stressed, pathological and dying states. We cannot speak about living systems after death.

Table I. The levels of the laboratorial parametres

Parameter values	Zones	States of organism
Ss ↑ Si	Inviability	Agonizing zone
Fs ↑ Fi	Inactivity	Pathological (ill)
Vs ↑ Vi	Dangerous	Stress
Ms ↑ Mi	Admissible	Healthy (normal)
Os ↑ Oi	Optimum	
Ms ↑ Mi	Admissible	
Vs ↑ Vi	Dangerous	Stress
Fs ↑ Fi	Inactivity	Pathological (ill)
Ss ↑ Si	Inviability	Agonizing zone

In case of living systems the negative feedback regulation known from cybernetics is available only in the optimal range, as the other ranges are asymmetrical and due to this fact a modified negative feedback is created in which the regulation of major and minor ranges is not uniform!

The negative inverse connection functions “constantly” and its main role is, to maintain certain functional parameters of the body to a relatively constant value. This is about a relative stability, since the adjustment involves oscillations around an abstract medium value with a tendency to minimize the deviation in respect of this mean value.

Let's denote with $o(t)$ the exit output and the mean value of the characteristic parameter on the system is $o^*(t)$; after the adjustment, the values of the outputs obtained shall be denoted with $o(t_1), o(t_2), o(t_3), \dots, o(t_n) = o^*(t)$;
if $t_1 < t_2 < t_3 < \dots < t_n$.

We talk about a negative inverse value, if the following two conditions are satisfied:

$$|o^*(t) - o(t_1)| > |o^*(t) - o(t_2)| > |o^*(t) - o(t_3)| > \dots > |o^*(t) - o(t_n)|$$

$$\frac{d|o(t_i) - o^*(t)|}{dt} \leq 0$$

In the living organisms, all the mechanisms for maintaining a constant composition and internal environment function on the basis of on negative feedback.

In case of living systems, due to excessive stress or exterior factors – not necessarily pathogenic – the organs can be subjected to the so-called perinormal state and changes located on the verge of normal and pathological states, being evaluated based on special criteria. The interconnection of phenomena of protection, resistance and adaptation belong mainly here, exceeding the normal limit, but not reaching the limit of pathological state. For example, in case of a not properly prepared sports-man the short-term cardiac dilation after a great strain is not considered as normal, but not even pathological (provided that the physiological balance of the individual is soon restored) [11, 12]. If due to the effect of physical effort without medical control the eccentric hypertrophy gets permanent and the so-called „sports heart” is this way created, this state approaches the superior limit of perinormal and – if the dilation of the left ventricle is associated with the dilation of the heart – it is already considered as pathological state. The morphological image of smoker's lungs is similarly evaluated initially not showing pathological changes, but it cannot even be considered as normal, later on a perinormal base chronic bronchitis, lung dilation, associated cardiac modifications or quite frequently even lung cancer can appear, with different intensity depending on each case.

The Theory of the Stress

Selye's theory of stress was already launched in 1936 when he described the General Adaptation Syndrome [13]. Although the notion of stress was first used in 1914 by Cannon, the Bostonian physiologist, in his work discussing the relationship between endocrinology and neural phenomena, the realization and descrip-

tion of the notion of stress as a pathophysiological phenomenon is associated with the name of Hans Selye. In pathology as well as medical practice the concept of the „specific” had been predominant since Virchow. Only those symptoms, alterations were taken into account which specifically differed (in colour, size, touch, sensitivity etc) from the ones considered healthy. The 19th century pathology development as well as clinical diagnosis were based on this concept. Hans Selye, while a student in Prague, already observed what others failed to notice, namely that there are many similarities among the various illnesses. However, due to their general nature these did not help the physician to make a proper diagnosis, thus they were overlooked. It struck Selye though that those hospitalised with various disease all looked more or less distressed, weary or restless, feverish, pale or flushed as the case may be. He came to the conclusion that in most cases these symptoms were more or less identical. His attention was caught especially by the “physical symptomatology” [14].

The concept of stress pervaded the medical mentality and opened up new ways for a better understanding and successful treatment of certain diseases. Nowadays, this concept resulted from animal experiments has significantly more „chronic” clinical and social aspects than strictly pathological. No doubt that the discovery and definition of stress was the greatest biomedical achievement in the 20th century, which shaped our thinking from many aspects. With the help of his animal experiments Hans Selye launched a new, wider physiological and pathological, biomedical approach, which provided an opportunity to see through the „specific” and realise and utilise the significance of the „non-specific”. The combination of today's molecular biology, genetical „in vitro” results with Selye's „in vivo” views seems to be most promising, yet we must keep in mind that the range of evaluation of in vitro results need to be in accordance with the „in vivo” [15, 16].

It is due to Selye's discovery that the idea of aspiring for stress-free, stress-minimising life style pervaded all professions where prevention is considered important. Stress, respectively fighting against stress became an everyday reality eg. developing a friendly work place, preventing eventual detrimental effects at work, livestock-farming and productivity, etc. All fields are searching for solutions against stress with more or less success to reduce stress to acceptable levels. Thus the medical-biological discovery of stress has become a philosophical concept serving the daily practical interests of mankind.

The Psychological Balance

The greatest loss is the mourning known by everybody. The mourning reaction has a regular course giving rise to psychical injury and one needs a certain definite time for its conscious treatment. Because of the shock we don't believe, don't accept the reality. Shock retards, delays every psychical function moreover sometimes temporary constriction of mind sets in. Doubts, scruples, charges and self-accusations take their origin but mourning passes off in the form as it is prescribed by the tradition how one must adapt such occasion. To have respect for the cultural tradition, to keep customs and rites facilitates the process of the mourning being a diverting scheme. Death arises in the mind, the person left alone struggled against despair, vacuity and hopelessness feels the final secession [17].

The natural mourning, lasts for 6-12 months. Henceforth living have to speak without sorrow of the deceased. The survivor has to create new connections setting in the positive identification. During the treatment of mourning it is first the sorrow to be dominant and lessens by the time, the bequeathed things, inheritance are attended to care, testimony fulfilled and people try to do their best according to the deceased's wish which would have been liked to see. In this last tribute the apology is included, too. The man having lost his last connection with the world grieves double and his environment must pay great attention not to lose also him [18].

A state similar to the mourning reaction occurs on the course of stress condition due to losing parts of the body. After an accident or as the consequence of a disease surgeons often have to amputate. The final cessation of a lost function is a grave „object loss” after which one has to learn once more to live under other circumstances, to realize oneself by restricted living space and means of earning of a livelihood chance to learn with the special insufficiency feeling as he were of sound mind in an impaired body. Every medico-surgical intervention belongs to the stress factors [19].

Losing the native-, homeland elicit a grave stress condition the feeling of homelessness after a period of residence in a new, chosen country. In the new, recipient country the settler counts as a stranger and everything – beyond the elementary selfsufficiency – has to be learnt again on another basis, to live practically impersonal, „without countenance”. The nationalization of the private property, giving „in the hand of the people” the forfeiture of the property, losing the landed property set off an irreversible process which was equal with genocid and makes its effect feel for the time being. The loss of the personal goods and immovable property as the results of a lifetime work is again a new stress which cannot heal like the trauma of losing the homeland. The deprivation of protection means harmful stress for a lifetime. To be threatened by losing the living space, and to be in jeopardy appears as a fatal disease, as the experience of a catastrophe like a state after survival of a trauma. The loss of life space shows increased negative activity which lasts for a long time. The longer the threat and losing period of the life-existence space was the greater is the chance for an irreversible state to happen. Psychogenic damages proceed, previous pathologies recrudescence or worsen, turn into chronic. The uncertainty of existence, the threats menacing brings about mental crisis, personality impairment which in itself makes impossible the balanced participation in the society.

The subsistence is of vital importance [20]. The loss of a post-work (unemployment and worklessness) if somebody becomes unemployed through no fault of his own but by irrationality of mismanagement his working place have been reduced and passed over to foreigners then it means a mockery of the constitutional human right, the life element of man. The involuntary change of employment: re-education and retrained for other work is up to the stress of a personality change because the skill and experience gathered throughout a lifetime, the profession-conformed personality will be inhuman, cruel degrade to zero.

The appearance of life danger-threats provoke experience like disease, natural catastrophe or as the survival of war or an accident.

The destructing elementary calamities signify increased threats because possessing the same chance one cannot figure out who shall survive and who falls victim to. The man who had thought of his invulnerability suddenly realizes the critical situation that he is in the centre of the catastrophe. People behave embarrassed in every life danger, in fact they don't grasp by-gones and drift along with the tide. War brings about stress reaction similar to the symptoms of the life-danger stress. Both contain psychopathological elements and a long psychotherapy accomplished by a specialist is needed, considerate-protective environment for the accommodation in the normal life, for the resocialization.

In the state of isolation there arise affective disturbances specious solutions to give themselves purpose and task. The sexual life, the instinct of self-preservation belongs to the line of instinct frustration. To give it up, to cease it, induces stress process. Nourishment also belongs to the instincts. Keeping the dietary prescription or the over-eating as supplemental actions are not primary stressors but the consequences of secondary problems of other nature. In childhood, the stress is diffuse and multicausal, the appearing disturbances are: negativism, elective mutism, resistance-spite and fit of fury, opposition, aggression, eating disturbance, emptying troubles. In the case of children these are notorganic manifestations but prove the loosened connection with their surroundings, their therapy shouldn't aim the conscious treatment of life-danger or threats.

On middle and long course, the effect of stress elicit about psychosomatic diseases (hypertension, cardiac and colon problems, etc.) in the general state of health it means disappointment, with drawal from the activity, depression. There are changes also in the social behaviour: conflicts become critical, aggressive actions against others thicken, the tolerance threshold of the individual diminishes. Set out from these facts we can declare: the more invalid is a population the worse is the quality of the social life.

Conclusions

Every man is a constituent part of a social organ. It is for this very reason not surprising that with man the original reason of stress conditions is his social milieu minimum in 90%. On the basis of the results of scientific researches the strongest stress overtaking the man is the death of the partner in marriage if they lived together more than 15–20 years. This is followed by consequences of the judgements, by the courts of justice, the main force organization of the state: (prison, loss of flat, homelessness, deprivation of own individual values, significant fine (penalty), divorces. Judgements are preceded by lawsuits, usually for more years sometimes even for decades and the verdict of the court can hardly passed through but as an unforgettably negative frustration and its consequences cannot be treated till the end of life. Of this verdict one never can get rid and as an extreme burden has to be dragged along for a lifetime, actually one becomes a denounced, branded individuum. Followed by life-uncertainties created by politicians: nationalization, war, corruption, unemployment, financial difficulties, falsehood. Then the fourth most important concretization: strained relations in the place of work, the complete loss of the independence, continuous cheating out of the profession from the side of the heads, leaders, their continuous, sly offence against one's personality.

By means of pur biological endowments and in consequence of nowadays medical technics man could have lived 120-150 years but the stress conditions affecting us during our life shorten it by more decades. The secret of longer lifetime is to avoid stress conditions because it yields the accumulation an inner surplus energy and lessens the wear and tear of the organism originating from the normal physiological processes.

References

1. Vincze J (2007) Biophysical aspects of the Stress. NDP P., Budapest.
2. Vincze J (2015) The Biophysics is a Boderland Science. Second Ed. NDP P., Budapest.
3. Vincze J (2018) Medical Biophysics. NDP P., Budapest.
4. Vincze J, Vincze-Tiszay G (2020) The Biophysical Modeling of the, Seven-Dimensional” Man. Int. J. Recent Sci. Res 5: 123-130.
5. Vincze J (2020) The Biophysics of the Human Apparatuses. NDP P., Budapest.
6. Vincze J, Vincze-Tiszay G (2020) The Biophysical Modeling of the different Regulations in the Human Organism. Intern. J. Inovat. Studies Med. Sciences 4: 1-4.
7. Vincze J, Vincze-Tiszay G (2020) The Biophysical Adjustment in the Human Organism. J. Med. Res. Case Report 2: 1-7.
8. Vincze J (2007) Interdisciplinarity, NDP P., Budapest.
9. Vincze J, Vincze-Tiszay G (2020) The Biophysical Modeling of the Evalu-a-tion of the Labo-ratorial Diagnosis Zones. American Journal of Internal Medicine 8: 1-7.
10. Vincze J (2020) The Biophysical Modeling of the Apparatuses in the Human Organism. Lambert Academic Publishing, Berlin.
11. Shilds G S, Sazma M A et all. (2017) The effects of acute stress on episodic memory. Psychol. Bull 143: 636-675.
12. Starcke K, Matthies B (2016) Effects of stress on decision underuncertainty. Psychol. Bull. 142: 909-933.
13. Selye H (1936) A syndrome produced by diverse nocuous agents. Nature 1936; 138:32.
14. Selye H (1955) Stress and disease. Science 122: 625-626.
15. Campbell G S (1977) An Introduction to Enviromental Biophysics. Springer Verlag, New York, Heidelberg, Berlin.
16. Chapman D, Leslie R B (1967) Molecular Biophysics. Oliver and Boyd, Edinburg.
17. Vincze J, Vincze-Tiszay G (2020) Some Aspects of Sciences from the Biophysical Point of View. Int. J. Software & Hardware Engin 8: 103-108.
18. Vincze J (2008) Biophysics, Physiologic and Patophysiologic of the Stress. NDP P., Budapest.
19. Vincze J, Vincze-Tiszay G (2020) The Biophysical Modeling of the different Regulations in the Human Organism. Intern. J. Inovat. Studies Med. Sciences 4: 1-4.
20. Vincze J (2015) Biophysics. 5th Ed. NDP P. Budapest.

Copyright: ©2020 Janos Vincze. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.