

A WAY TO HEALTH THROUGH PSYCHO-IMMUNOLOGICAL WELL-BEING:
EXAMPLE OF INDIGENOUS PEOPLE OF RUSSIAN NORTH

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Abstract

The research was carried out into the changes within psychic and immune domains of the Russian Nenets people migrating from the traditional northern habitat (tundra) to urban environment. It is noted that in the process of significantly changing lifestyle supposedly single ethnic group can be clearly sub-divided according to the differences in adaptation dynamics. This division reflects sociological differences and is connected to the psycho-immunological aspects. Thus, with the adaptation of forest Nenets to the new conditions of existence (from the tundra to the urban centers), we found a division of a whole ethnic group into two groups according to a social attribute, which is fixed at the psychophysiological level. First, psychic and immune domains are not only sharing a number of common features but also can have deep evolutionary connections and can be governed by similar laws. Second, the psyche and the immune system show the most important functions and properties that ensure an effective existence, generalizing the values of adaptation, protection and vitality into a single structure. Such a concept is closed to “wholeness” and “integrity”

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showing that the distribution of vital forces or body resources can adjust the condition or cope with the pre-illness or even disease.

Keywords: Forest Nenets, Russian North, psychic, immune, endocrine system, tundra, urban center

Relevance

Modern North is a complex and multi-faceted system where urbanistic eco- and socio-system with its mines, factories and cities cohabits and collides with the historic way of life of Nenets indigenous people engaged in traditional activities (reindeer herding, fishing) living in traditional tents and temporary dwellings, with traditional ways of cooking, arts and crafts. Their beliefs formed under the influence of the traditional national culture are quite traditionalistic, animating the world around them and interacting to the multiple spirits. Their way of life is strongly coherent with living environment as it is also common with other indigenous people of north and arctic. But with increasing development northern and arctic territories are rapidly urbanized, which leads to an increase in migration of indigenous peoples between two very different environments. A certain part of the indigenous population of tundra inevitably moves to the cities towns and modern villages. Very often this process begins when children are starting to study in a boarding school. Then they continue their studies and could be followed by the whole families moving away from their traditional environment to live and work in the urbanized areas. This implies significant changes in the lifestyle of the indigenous population. A certain part of the indigenous population goes back to the tundra and tries to refit into the traditional way of life after graduation, bringing home modern appliances and technologies that actively penetrate into the traditional lifestyle. Today in almost every tundra tent one can find television sets, washing machines, microwave ovens, computers and mobile phones (Sarnyai, Berger, & Jawan, 2015; Kue Young, Kelly, Friborg, Soininen, & Wong, 2016; Nadtochiy, Smirnova, & Bronnikova, 2015; Burtseva, Uvarova, Tomsy., & Odland, 2014).

Such changes are simultaneously happening at different levels of the organization of human life and life-support systems. Dramatic changes in the lifestyle and the drive

for personal development engage adaptation mechanisms at both psychic and physiologic domains that should be detectable within different levels and mechanisms including general health, vitality and longevity, mental and psychological health, socialization (Gavrilenko, Es'kov, Khadartsev, Khimikova, & Sokolova, 2014; Lyudinina, Eseva, Potolitsyna, Chernykh, & Bojko, 2014).

State of the problem

Psychic and the immune domains comprise the key mechanisms of human self-regulation and adaptation (Bogdanov, Dotsenko, 2010; Mikhaylenko 2012; Quan N., Banks WA, 2007; Capuron et al, 2007; Pacheco-Lopez G., Bermudez-Rattoni F., 2011; Daruna, 2012; Dotsenko et al, 2013; Lanin, 2013; Suhovey et al, 2016; Fisher et al, 2016). Historically it was assumed that psychic and physiological (including immune) domains are independent and autonomous. But recent research shows that these two domains share a number of similar key features and mechanisms, and possibly have common evolutionary-developed strategies and laws (Suhovey et al, 2014; Fisher et al, 2016). This findings lead to the assumption that such domain separation may be artificial. There is reason to suspect that apparent synchronization of “mind” and “body” (psychic and physiological, in particular immune domains) manifesting itself through similarities in operation strategies, psychological and physiological adaptation dynamics and apparent functional duplication and complementarity of the processes (Suhovey et al, 2014.) is due to the plane fact that we are studying infinitely complex, in reality probably inseparable system – a *human being*. Taking into account a gap that exists in the knowledge about this extremely complex system and basing on the pool of facts available today, it is possible to make a conclusion that there are two separate systems (psychic and the immune) working together to provide optimum adaptation to the life conditions and maintain the required level of the human body resources.

It does not seem proper to discuss the above dilemma “separable or inseparable” in terms right/wrong. Human being is probably the most complex system we are studying today. Modern science is just approaching understanding of some features of the simplified formal-mathematical systems with closing to infinity number of degrees of freedom (Feranchuk et al, 2014). And one of the conclusions is that with the number of degrees of freedom increasing

towards infinity, system can gain unique properties that are not inherited from its ancestors with small numbers of degrees of freedom, this making psychic and the immune systems in a sense “inseparable”. The number of “degrees of freedom” in of the *human being* life system is as close to infinity as one can imagine. It may happen that certain features of its functioning cannot be explained through the reduction and constructing dynamic models covering only certain manifestations (psychic and immune domains etc.). And apparent contradictions and coincidences between the two domains should be regarded as a traditional way of knowledge development: thesis, antithesis, synthesis. Thus it is quite important working not only on gathering new facts and clarifying existing “separate” approaches, but considering possible “unification” of approaches at higher abstraction levels (Bakcheeva, Gorbach, Aljamovski, & Mikhailova, 2013; Galantyuk, Isaeva, 2015).

According to A.V. Poletaev (1993) nature is strikingly “economical” and tends to safeguard through evolution most general, universal principles and mechanisms that can work effectively in a variety of situations. As a result high-level mechanisms have remained that select the necessary programmes to survive and adapt to any conditions. It is assumed that the main function of maintaining the viability of human being in the social environment is delegated to the psychic domain, reflected in the dynamics of mental (cognitive) processes (reflection, perception), and to the psychological defense mechanisms (primary and secondary) working to minimize the negative impacts. On the contrary, immune domain is maintaining the viability and integrity of live organism at the “inner body” level (Petrov, 2016). Therefore, specializing in areas of “responsibility”, the psychic and the immune domains have kept the general principles of operation: each one performs adaptation by means of structural and dynamic customizations of own activity under changing environmental conditions. Hierarchy of these mechanisms can be described as follows:

- The activity of the human being in general, and of its organs and smaller structures, in particular, is dynamically adjusted to the vitally critical changes in the environment. Within the psychic domain it is performed through the feedback activated by sensors and receptors; in the immune domain it is performed through the activation of the lymphocytes with their receptors etc. This can be categorized as generalized (non-specific) mechanisms.

- In order to “speed up” adaptive responses certain patterns are preserved as “templates”. Corresponding patterns are represented in the psychic domain by memory, cognitive process pathways, neural and cerebral formations. In the immune domain these are represented by the sets (“libraries”) of the specific molecular structures (receptors) and antibodies, hormone and protein compounds, etc. This can be categorized as differentiated (specific) mechanisms.

Both domains apparently are solving similar problems and have similar solution scenarios.

- *Recognition of the threat*, its categorization and classification: certain object, being or phenomenon is connected to a category among all dangerous or harmful factors.
- *Forecast of the situation development*, its categorization: relating to the phenomena that have been dealt with before and constructing corresponding templates through analysis of earlier actions. The forecast is related to the processes in memory and to the capacity of the being in collecting, storing and updating traces of previous interactions.
- *Blocking and counteracting the malicious agents or factors in order to avoid or reduce the damage*: learning from behavioral, generalized (non-specific) patterns, aiming at generating faster response mechanisms that can be used in identical or similar cases in the future.
- *Accumulation and storage of most successful templates*: generation and formation of hierarchical structures of the strategies and specific patterns capable of maintaining physical and mental health under changing environmental conditions (related to both “inner” and “outer” space).

It should be noted here, that speeding up responses of the regulatory and feedback systems based on generating certain “inner templates” are well known in the neural network-based systems (Csermely, 2016; Lee et al, 2004). It is more than a coincidence, as neural networks are supposed to be modeling the processes happening in the brain (Galantyuk, Petrov, Procopenko, & Shanina, 2013).

Our research approach is turning to complex situations in which environmental conditions are changing quite abruptly, but the sample group of research subjects experiencing changes is more uniform than one can possibly select in the general population.

Such situations can help clarify certain tendencies and draw better conclusions as the errors in the resulting statistics tend to be smaller (Sukhovey et al, 2016). In this case, we have chosen an ethnic group of indigenous people of the Russian North, Forest Nenets, relatively small isolated population with very traditional lifestyle disturbed today by industrialization and urbanization. Indigenous peoples of the North and Arctic are also known to have the capacity to survive in extreme conditions still maintaining good health and longevity, supposedly due to keeping inner peace and integrity.

The goal of research is to study the functional coupling of the psychic, immune and endocrine domains/systems during the adaptation to extreme changes in the environment (physical and social) using an example of the urbanization-forced migration of the Forest Nenets, indigenous people of the Russian North.

Materials and methods

The study was conducted in the Kharampur village and “Chebacjhe” camp (the southern part of the Purov region of Yamalo-Nenets Autonomous District, in the northern taiga subzone of the Russian Federation). This area is 120 km away from the nearest district center Tarko-Sale. The village is quite modern with one- and two-stored brick administrative and residential buildings. It has centralized water supply, sewerage and heating networks, asphalt and concrete coated streets. The industrial zone has boiler and transformer stations, fish storage and processing plant, fire station. “Chebacjhe “ camp is located in a wooded area 15-25 km from the village. People are living there in the tents made of natural materials like reindeer skin and wood (“Chum”) 2-3 km from each other covering the area in the radius of 10-12 km. A total of 75 indigenous people took part in the study. Data analysis was carried out for the whole group of the subjects and separately for the two separate sub-groups: the Nenets who “live in the wild” (in the camp), and the Nenets who live in the urbanized conditions (the Kharampur village). It should be mentioned, that genetically the whole group is rather homogeneous: all belong to the traditional ethnic community living in relative isolation until recently. This ethnic group for historically long time have experienced stable climatic, geographic and cultural environment, and social conditions and accommodation (with related aspects included) being reasonably independent variable factors.

The first group consisted of 36 Nenets living “in the wild”, mainly engaged in fishing, reindeer herding and housekeeping (natural conditions). Most of them had neither secondary nor higher education. The mean age for the first group of participants was 41.48 ± 1.85 years. The second group consisted of 39 people (aged 36.25 ± 1.98 years) of the same ethnic group, lived and worked in the village (urban conditions) for a long time. About 75% of them had a higher education, and 25% - secondary education. All participants have signed informed consent forms. The study was approved by the local Ethics Committee, on the basis of the Constitution (Articles 18, 20, 21, 22, 28 and 41) and the Federal Law №323 from 21.11.2003, the “On the basis of protection of health of citizens of Russia” (articles 18-22).

Interviews were carried out and a questionnaire was used to assess the psychological characteristics of the participants in particular the “aggressiveness” and “hostility” levels (Buss, Durkee, 1957). In the present context *aggression* was used to describe certain human responses, characterized by the presence of destructive tendencies; and *hostility* was used to describe reactions, developing negative feelings and negative evaluations of people and events. Three indices (“physical aggression”, “irritation” and “verbal aggression”) calculated from the questionnaire data (Buss, Durkee, 1957) formed a cumulative index of aggression, determining the overall active reaction towards other individuals. Indices “insult” and “suspicion” formed a cumulative index of hostility, determining generally negative, skeptical attitude towards others. The values of cumulative parameters of aggressiveness (21.0 ± 4.0) and hostility (7.0 ± 3.0), both in relative units, were considered as “normal”, while the values exceeding these corresponding reactions were regarded as aggressive and hostile.

Evaluation of immune and endocrine system response parameters was performed by enzyme immunoassay (ELISA) using universal photometer Anthos Reader Zenyth 200st (Biochrom, UK). The functional activity of T-cell immunity was assessed by the level of blood serum level of cytokines IL-4 and IFN- γ , which were determined using the bioassays produced by the company VECTOR-BEST. Molecular integrity of the immune system functioning was assessed using the serotonin and cortisol levels. Cortisol level was measured using reagent set produced by ALKOR-Bio (Russia); serotonin level was measured using corresponding reagent by IBL International (Germany, Hamburg).

Statistical analysis of the data was carried out using statistics software package SPSS 11.5 by Microsoft (mean, variance, average, parametric comparison of the Student's criterion, Pearson correlation coefficients, and ranking).

Results and their discussion

Resulting data extracted from the questionnaires according to Buss, Durkee (1957) indicate that for both sub-groups cumulative index of aggression does not exceed normal levels (see Table 1, Figure 1).

Table 1.

Comparison of the aggression and hostility related indices for the studied Forest Nenets sub-groups

Calculated indices		1 sub-group "living in the wild"	2 sub-group "living in an urban environment"
Cumulative aggression index	Index "physical aggression"	5.58±0.49	6.22±0.59
	Index "irritation"	6.25±0.52	7.22±0.57
	Index "verbal aggression"	7.41±0.78	7.33±0.50
Cumulative hostility index	Index "insult"	3.91±0.54	5.66±0.49*
	Index "suspicion"	4.91±0.56	6.55±0.50**
Individual characteristics	Index "indirect aggression"	4.5±0.58	5.11±0.54
	Index "negativism"	2.66±0.37	3.33±0.23
	Index "guilt"	5.58±0.65	6.00±0.70

Corresponding reliability of the difference between sub-groups: * - $p < 0.05$; ** - $p < 0.01$

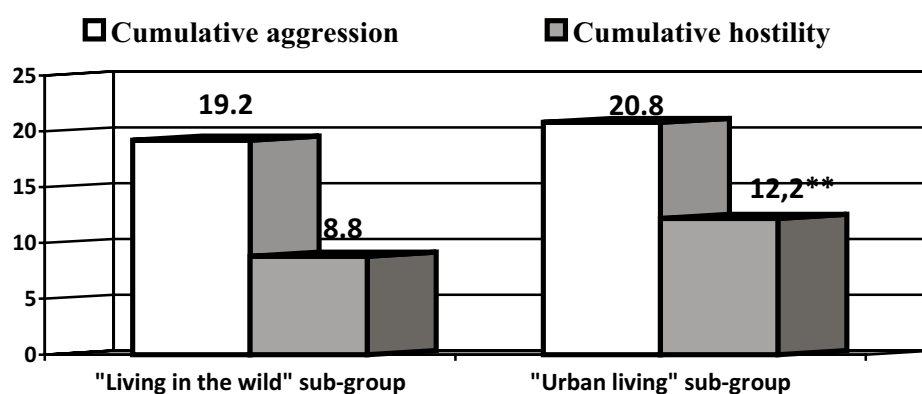


Figure 1. Cumulative aggression and hostility indices for the studied Forest Nenets sub-groups.

Corresponding reliability of the hostility index difference between sub-groups is $p < 0.01$

Significant differences between the surveyed groups were found only for the indices “insult” ($p < 0.05$) and “suspicion” ($p < 0.01$) forming a cumulative hostility index. In both cases the values for the “urban living” (Kharampur village) sub-group were significantly higher than those for the indices for the “living in the wild” (camp) sub-group (Figure 1). The results of the tests can be interpreted as indicating higher envy and hatred towards others, lack of confidence and caution in relations with other people for the “urban living” sub-group. Apparently, those Nenets who have migrated to urban conditions experienced an increased concern for the survival under new (non-traditional) circumstances (not having mastered the rules yet). Apparently it can be considered as a special case of a search response (omnidirectional activity). Possibly it is a sort of mechanism helping to increase the anxiety and to speed up responses through treating all others as potential threat. Being a part of a social group these individuals can also cause similar responses from the others, which contributes to overall situation together with other external conditions perceived as “potentially hostile”. One can, therefore, consider changing conditions due to the relocation/migration between the different environments (infrastructure, quality of life, social contacts etc.) as a trigger for changing the functional state of the psychic domain. And certain mechanisms within this domain are relevant to the constructive strategy of adaptation, which is reflected in the changing behavioral patterns. It is possible to conclude that changes of the living environment of the initially homogeneous group of indigenous people lead to qualitative changes in the psychic domain and help clear distinction between the corresponding sub-groups related to these differences in the environment.

The analysis of hormonal content (cortisol and serotonin) in blood serum did not reveal significant differences between the sub-groups of surveyed Forest Nenets, and these figures did not exceed the reference values (Table 2). At the same time there are strong correlations of cortisol level (a marker of stress reaction) with the indices of “verbal aggression” ($r = -0.87$, $p < 0.01$), “indirect aggression” ($r = -0.70$, $p < 0.05$) and “guilt” ($r = -0.68$, $p < 0.05$).

Table 2.

Comparative characteristics of the immune and endocrine indicators of Forest Nenets

Corresponding levels:	1 sub-group "living in the wild"	2 sub-group "living in an urban environment"	Reference ("norm")
Serotonin, $\times 10^{-9}$ g/ml	315.15 ± 30.95	359.51 ± 34.01	40-400
Cortisol, $\times 10^{-9}$ mol/ml	398.56 ± 40.16	368.84 ± 36.95	150-660
IL-4, $\times 10^{-12}$ g/ml	3.12 ± 0.53	$5.17 \pm 0.59^*$	0-4
INF γ , $\times 10^{-12}$ g/ml	20.24 ± 2.11	$3.22 \pm 0.31^{**}$	0-15

*Corresponding reliability of the difference between sub-groups: * - $p < 0.05$; ** - $p < 0.01$*

Serotonin is known to be a neurotransmitter involved in the regulation of feeding behavior and certain mental processes (impulsiveness, mood, etc.) and cognitive processes (concentration, attention, Schuur et al., 2014). So the positive correlation between serotonin levels and the “verbal aggression” index ($r = +0.72$, $p < 0.05$) is unexpected. There is no stress (by judging from the serotonin level), but “verbal aggression” is present. It implies that we actually deal not with the search type adaptation mechanisms, but probably with increased aggressiveness “in return” (mainly manifesting itself as verbal aggression) as a reaction to the generally increased levels of surrounding social aggressiveness. One can presume that in the process of adaptation certain external factors (or complexes of factors) trigger a functional reorganization of the endocrine system. Probably endocrine processes are also developing certain reaction patterns basing upon the accumulated experience of interaction with the environment, which is beneficial in the competition for “increased quality of life”.

The analysis of markers of humoral (IL-4) and cellular (INF γ) parts of the immune system (Table 2) indicates that for the Forest Nenets living in an urban environment the level of IL-4 is 1.6 times higher ($p < 0.05$), and INF γ - 6.3 times lower ($p < 0.01$) as compared to the corresponding values for the Nenets living in tundra (“living in wild”). It may indicate a change in patterns of functional activity of the immune response. Perhaps this is due to an exogenous spectrum of the protein antigen loading. In particular, viruses and bacteria mainly cause activation of the Th1 lymphocytes, while parasites and allergens predominantly cause Th2 lymphocyte activation. At the same time direct correlation of IL-4 levels with the “guilt” indicator ($r = 0.78$, $p < 0.01$) was found for the Forest Nenets living in an urban environment.

Thus, we can clearly observe the difference in the two sub-groups of the single (and supposedly uniform) ethnic group when people are adapting to the changing environment and lifestyles (living “in the wild” or living in an urban environment). These differences are connected to the social factors, but are also mirrored as certain differences in the psycho-physiological reactions in process of adaptation. It is also possible to assume that the immune defense (cell level) is mainly responsible for dealing with the changes in the physical environment, and humoral defenses- for building/changing relationships (especially for the interpersonal communication), but this hypothesis requires a special verification. Some researchers are even proposing that the immune system can be regarded as a kind of special sensory organ (“the 6th sense”), which was formed in the course of evolution and serves for the perception and processing of a variety of stimuli (Camara, Danao, 1989, Ferenc, Strtinov, 1997). However, this assumption is not proved for the moment. Our results suggest that adaptation processes can be supplemented (either causing direct changes or just followed) by the establishing of specific patterns of the immune response. Perhaps the humoral branch of the immune system is connected to (may be responsible for or provide resources to) building social relationships under significant changes in the environment (in our case between two different physical environments and lifestyles). Though it is not possible at the moment to speculate about causality in the relations between the adaptation and immunity, but it is experimentally clear that changes in the natural conditions of existence of small indigenous population of the North lead to the qualitative (but measurable) changes in the immune system operation. The same time there are no statistically reliable differences in the endocrine system of two population sub-groups, but endocrine responses are clearly connected to the adaptation processes (this is confirmed by the corresponding correlations). Again no conclusion on the causality can be made in this case basing solely upon the existing data.

Apparent connection between the adaptation process, and the psychic and immune responses discussed above, supports the hypotheses that psychic and immune domains are jointly involved into the most important and critical life support activities, linking adaptation and protection tasks into a single meta-system (Sukhovey et al, 2014).

It is not possible to speculate yet if moving to rural environment will cause any long-term health consequences or changes in the longevity for the Nenets people who have moved to the rural lifestyle. But Nenets folk living traditionally are proverbially illustrious of being calm, placid, being generally healthier than other Russians and commonly living longer life in peace with themselves and with the extreme nature of the North. But examples of successful adaptation of the Nenets sub-population moved to the rural living indicates that major “body and mind” resources can be effectively re-distributed to cope with quite extreme survival challenges. And it is also feasible that indigenous Nenets population has a high adaptation capacity also in the case of coping with disease and pre-disease conditions, and corresponding re-distribution of the “vitality resources” may be achieved via the psychic domain. And psychic health help immune system to keep physical health. This in a sense supports the holistic approach to the health care when mind and body are treated as integrated and inseparable.

In present research there are possible factors that can potentially bias our results or bring errors. There is a difference in the average age of about 5 years between the two groups of participants. And the group living traditionally (“in the wild”) is some elder, whereas younger people are usually considered to be more adaptable. But both groups represent mature people in the prime of their life, not youngsters at all, and thus we do not expect significant influence there. Another potential issue can be related to the size of test groups. It may be possible to widen the studies including people from other villages, but it may disturb the genetic uniformity of the test subject group. In our studies we conducted the tests with the group of Nenets people from the same localized area who can be treated as a kind of large “extended family” and in many cases are genetically related.

Conclusion

Possible connection of adaptation mechanisms to the responses in psychic and the immune domains was studied with the group of indigenous people of the Russian north, Forest Nenets forced to migrate between two different environments and lifestyles. It was found, that:

- Forest Nenets, constantly living in the village (urban environment) have increased levels of psychological and physiological tension: higher “insult” and “suspicion”

indicators and lower levels of IL-4 and serum INF γ , as compared to the ones living in traditional environment (in the camp).

- There were no differences between the groups in the expression of stress-reaction at the physiological level: there is no significant change in the level of cortisol and serum serotonin.

Acquired results additionally support the hypothesis of apparent connection between the psychic and immune domains. In the particular example, both domains seem to be jointly involved into the process of adaptation to the life conditions, and are jointly maintaining the required level of resources of the human body, linking adaptation and protection tasks into a single meta-system.

It is also possible to assume that the immune defenses (cell level) are mainly responsible for dealing with the changes in the physical environment, and humoral defenses-for building/changing relationships (especially for the interpersonal communication), but this hypothesis requires special verification.

Examples of successful adaptation of the Nenets sub-population moved to the rural living indicates that major “body and mind” resources can be effectively re-distributed to cope with quite extreme survival challenges. Corresponding re-distribution of the “vitality resources” may possibly be achieved via the stimulation of psychic domain, and so the psychic health can be helping immune system to keep physical health. This in a sense supports the holistic approach to the health care when mind and body are treated as integrated and inseparable, and that mind can influence the body and vice versa.

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