

Temperament – environment or gene?

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Abstract

In this paper we aimed to discuss about a controversial topic. To achieve this objective, we formulated arguments and counter-arguments in favor or against things found in literature. It is important to understand that temperament is influenced both by the environment and the gene, and a separation of the two is purely didactic.

Temperament is defined as dynamic-energy, reactive and regulatory side of personality. We believe that there is a strong relationship between temperament and environment and between temperament and genes; each of these relationships can be seen in the context of moderation or mediation by the other factor; the relationship temperament-gene can be moderated by the environment and temperament-environment relationship may be mediated by the gene.

Keywords: *temperament, environment, gene, personality, epigenetic status*

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I. INTRODUCTION

Temperament – environment or gene? is intensely debated topic both by psychologists, geneticists and bio-chemists, because temperament is one side of the personality, for whose development binds the development of subsequent constructs such as learning and performance in learning, but also in other areas of activity or predisposition to a certain type of psychiatric pathology. It is also important to study such themes to highlight the origin of human individuality.

Temperament is defined as dynamic-energy, reactive and regulatory side of personality. From this perspective this side of personality is rooted in the size of the biochemical plan. Most authors argue that it is innate, individual temperamental differences are visible from childbirth and relatively invariant throughout life. They are relatively invariant because in their basal structure can appear changes, sometimes substantial changes, produced by the interaction with the environment in which the person lives. It has been shown that impulsiveness, as a temperamental trait, has a biological basis, on which acting various environmental factors, succeeding thus to obstruct the manifestation of the biological basis or to facilitate in behavioral plan (Zuckerman, 2005).

Temperament was also defined as reactive and regulatory side of the personality. Reactivity refers to excitability and behavioral physiological systems of the body, resulting in emotional and motor responses. Self-regulation covers all attentional, behavioral and neural processes (excitation and inhibition), which regulates reactivity. If genes are given individual differences in both processes, for self-regulation, a strong voice is environment / education, because in this way it is formed the defining mark of each person (Rothbart, Derryberry, 1994).

Until the present, the researchers concluded that temperament is the side of the personality, which is influenced both by genes and environment. The interaction between the environment and gene refers to the sensitivity or the genetic susceptibility to the environment. The environment may change the temper gene expression, and genes may mediate the relationship between temperament and environment (Rutter, 2006).

II. EXPERIMENTS AND RESEARCH

Firstly, we believe that although studies have argued that genes contribute exclusively to individual differences, the environment can alter the biochemical genome and thus stable influence individual differences in neural functioning.

The development of research about the effects of environmental sustainability on brain development and its operation since childhood, were much anticipated such processes (Bateson et al., 2004; Gottlieb, 1997, 1998; Schneirla, 1966, cited by Meaney, 2010).

This approach provides for development as an active process of adaptation that occurs as a function of the ongoing dialogue between the genome and its environment. Charney and Heninger (1986) have argued that neuroticism appears to the existence of a greater amount of metabolite in plasma (MHPGG) of serotonin, but also in accordance with the occurrence of mutations in the serotonin transporter gene (5-HTTLPR), which does not occur in normal person.

Pezawas, Meyer-Lindenberg, Drabant, Verchinski, Munoz, Kolachana, and Weinberger, found that 5-HTTP promoter polymorphism and vulnerability to depression reflect a developmental process that affects structural and functional connectivity in a neural circuit that regulates emotional reactivity and fear. They said also that these functional deficits could be exacerbated by adverse environmental possibly affected by an ability to regulate emotional states during times of adversity of the environment.

Such an effect would be expected to lead to an interaction between genes and environment, interaction that gives the individuals vulnerability to the affective disorders. There is considerable evidence to support this hypothesis of development. Studies with rodents reveal a profound influence on the development of 5-HT neuronal axonal processes including germination. Diamond, Krech and Rosenzweig (1964) conducted an experiment on brain development in a rat race. They formed two groups, one experimental-subjected to a highly stimulating environment and a group of control-free environment subjected to stimuli.

After dissection rat cortex was found with a higher density, denser neural connections and a higher level of acetylcholine / ACH in rats in the experimental group than in others. The authors of the study explain that, no matter how good genes are, they cannot develop harmoniously, in the absence of an enabling environment. This process is the same with the event that an athlete develops his muscles only if doing exercises in the gym.

Secondly, we think that sharing a percentage greater influence of genes or environment on the temperament is purely statistical, using probabilities and still underdeveloped. In most research is used factorial ANOVA model, but only in research in which was studied the interaction between genes and environment on temperament by biological perspective (Meaney, 2010), without taking into account the possible influence they might have one from the other in defining phenotype. Moreover, variance analysis results are an attempt to understand the source of variation in phenotype in a population and not as an explanation of individual patterns of development, and another problem is the interpretation and appreciation of what these findings are not actually. For example, irritability is reduced to manifesting main effects in the case in which factorial ANOVA was applied, from environment and genes. So, a potential solution is to

use a model that emphasizes the connection between the two factors, several models of moderation and mediation, which would include social context and vulnerability-stress diathesis. The modern methodological approaches are rEG MODEL (passive gene-environment correlation model), which highlights the role of mediator gene (G) on the relationship between the child's temperament and the environment's home (E) and GXE MODEL, claiming that the relationship environment-gene would be moderated by the family of the child (taking into account the mother-child relationship, the physical environment at home, calm or chaotic environment, the relationship between father and child) (Lemery-Chalfant, Kao, Swann and Goldsmith, 2013).

There have been studies, not least, the monozygotic and dizygotic twins in terms of the proportion of genes and environment acts on temperament, but how to test raises some question. They used questionnaires which were applied to parents and teachers of these children. Indeed questionnaires such as the Colorado Childhood Temperament Inventory (CCTI; Rowe and Plomin, 1977), the EAS Temperament Survey (Buss and Plornin, 1984), used in research, as said by Gjon and Stevenon (1997) and Glodsmith, Buss and Lemery (1997), have all too good psychometric qualities, but avoid using observation method in different environments in which the child operates, we think it would be a limit to these researches. In addition, all these studies were usually correlational, and therefore cannot draw causal conclusions.

Moreover, we believe that the optimum methodology in studying this phenomenon is collecting data from both twin brothers, either monozygotic or dizygotic, in pairs. Also an analysis of variance genes and the environment on human behavior, it may reveal the differences and the common elements in perspective between the brothers and it could be completed with an MRI exam. So we can see more clearly how genes and environment interact and how they act on temperament.

Thirdly, we believe that there is a strong relationship between temperament and environment and between temperament and genes; each of these relationships can be seen in the context of moderation or mediation by the other factor (the relationship temperament-gene can be moderated by the environment and temperament-environment relationship may be mediated by the gene). Thus, Fischer, Sananbenesi, Wang, Dobbin and Tsai (2007) showed that an enriched environment correlated with changes in chromosome with changes in chromatin, meaning sustained action of inhibitors of histone-diacetilaza (HDACis) and the acetylation increased the terminal part of histone. This mechanism induced dendritic branching, the number of synapses, therefore allowing, within certain limits the restoration of the ability to learn and to the long term memory. Roth, Lubin and Sweatt (2009) demonstrated, on the other hand, that a hostile environment, trauma and maltreatment during early childhood, leaves persistent traces in biochemical substrate that can be observed throughout life and that can be transmitted transgenerational.

Researchers have taken tissue from the prefrontal cortex and hippocampus, which was used for the determination of the methylation pattern of the DNA. The results show that, at maturity, the prefrontal cortex of chickens abused in childhood is characterized by a loss of brain derived neural factor (BDNF in mRNA) compared with chickens kept properly. Mistreatment reduced gene expression of BDNF in prefrontal cortex. The pattern of methylation was conveyed to the next generations of chickens.

McGowan, Sasaki, Huang, Unterberger, Suderman, Ernst Meaney, Turecka and Szyf (2008) made the first study in humans in which it has been demonstrated that the social environment hostile (abuse and trauma in childhood) exert a strong impact on change rRNA, which will lead to some aberrations in the structure of mechanisms of protein synthesis in the brain and sustain significant suicidal propensities.

In interpreting these results, the authors asserted that DNA methylation is a stable process (link methyl-cytosine being one of the strongest links), differences in the pattern of methylation cannot be attributed to the conditions immediately preceding the suicide, nor of changes occurred post-mortem at the biochemical level. Thus, it is shown that the environment can change the epigenetic status of the genome that mediate the functions of neuronal, indicating differences in the temperamental characteristics.

Lemery-Chalfant, Kao, Swann, and Goldsmith (2013) states that family environment unsuitable genes passed on from parents to children could have negative consequences in terms of child development. Thus, the study made monozygotic concluded that a calm environment in which applied and respected rules, children had better voluntarily control. This correlation between environment and expressive temperament behavioral level was mediated genetic; children who lived in such conditions were introverted. Extroverted children, it was demonstrated that they came from chaotic family environments, without rules, a context that inspires insecurity and their volunteer control was very small.

The results of this latest research would be needed in the prevention of psychopathological disorders in children through the knowledge of the environment in which the child develops. Difficult temperament in infants, for example, evokes negative responses from caregivers. However, therapeutic intervention on the genetic parents can extinguish these negative influences, so that parents learn to respond to their infant irritability and maladjustment with patience and consistency.

III. CONCLUSIONS

We think that temperament should be seen as being on the side of the personality that acts both genes and environment in which they develop. The two types of influence should not be seen separately one from each other, but one in relation to the other. The interaction between the

environment and the sensitivity refers to the gene or the genetic susceptibility to the environment. The environment can change gene expression temperament, and may mediate the relationship between temperament and environment.

Dividing the percentage of influence larger environment or genes on temperament is purely statistical, using probabilities, and still underdeveloped, there were issues both in interpreting the results, comparing numbers, not the results of laboratory tests and in the generality of the results, the results relate to the entire population, but not to the development peculiarities of an individual. The key to the development of this field of study is to consider the limits of previous studies, and reporting of all results from the application of validated scientific evidence to the peculiarities of individual development of each individual.

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