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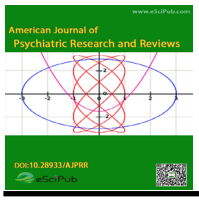

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Psychobiology in relation to beliefs, knowledge and feelings

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ABSTRACT

Background: Our anatomical-physiological nervous system, our beliefs, knowledge and affectivity are continuously interrelated, although they are often not well discriminated. **Method:** This is not a revision, but rather, a qualitative, narrative research, with inclusive and interpretative variables. **Results:** In practice, thoughts and feelings interwoven with actions conform the individual existential reality. The Jakob-Papez circuit of the limbic system is crucial to the processing of emotions, memories and learning. In particular, learning and memory need the integrity of the basolateral amygdala in the temporal lobe. It is indeed well known that the activity of the hippocampus and the amygdala is im-portant when it comes to memory. This paper will also comment on how stress affects learning and especially, the so-called emotional memory, and that both aggressiveness and violence, as well as the empathetic condition can all be considered parts of the same di-mension. **Conclusions:** One's will, beliefs and desires, integrated within the ideological domain explain, together with neurobiology, most of one's behaviors, including aggres-siveness in general, and violence in particular. We will also emphasize that stress expo-sure, which has such complex effects in the mnemonic encoding, can produce profound changes in physiology and social behavior.

Keywords: Affectivity; Knowledge; Memory; Psychobiology; Psychopathology

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Introduction

Human beings are rational and emotional biological entities, although there are frequent discussions about which comes first. Both fields are in constant interaction: emotions provoke thoughts, and thoughts generate emotions. Emotions induce to action, and fear is the most outstanding among them, even though its specific origin is frequently unknown.

From a neuroscientific perspective, and especially from a psychological and psychiatric one, it can be quite certainly stated that emotion decides and reason justifies. Psychology as a discipline is interested in behavior, mental processes and personal experience. Psychiatry, which is well aware of the brain's complexity and its effect on cognition, the state of mind and behavior, is essentially focused on the conduct that differs from what is usually accepted in the ordinary social environment.

Beliefs, knowledge and feelings are continuously interwoven, although they are not always properly discriminated. With this contribution, we will attempt to clarify their neuroanatomical bases, interrelations and some of their main consequences, especially in relation to mnemonic recovery, learning and behavior.

Materials and Methods

This paper is a brief and practical research on the most recent, high-quality, important international scientific literature about the neural, rational and emotional conditions of human actions. We will mainly address the complex correlations between neurobiology, psychiatry, biopsychology or the psychobiology of behavior, sexuality, memory, learning and fear.

Methodologically, this paper is a narrative research, not a revision. It is also qualitative, with inclusive, aggregative and interpretative variables. The aim of this paper is not to be exhaustive, but rather, to provide a panoramic vision of this variegated matter. This contribution is based on some of the most qualified published research, and its intent is to be clarifying, updated and unbiased.

Results and Discussion

● Biology, ideology, reason and feeling

In human behavior we can usually find overlooked communication practices. It is common, for example, that an individual tends to speak louder and change their volume during paralinguistic attempts to persuade. Such actions convey confidence and, at the same time, enable persuasion.[1] Interesting results have been published about simulated experimentation of a new interactive model to foster a favourable group opinion.[2] Even in the judicial sphere, the active communicator's charm influences their power of persuasion or credibility, even though that may not necessarily affect the results.[3]

People experiment confidence when they know they are right, and that confidence makes them persuasive. Certain psyche essays endorse the convenience of the integrated combination of knowledge, confidence and persuasion.[4] However, we cannot overlook the cognitive bias that results from the difference between what one knows and what one believes to know although they may not actually know it. The problem is, among others, accepting the limits of knowledge, which is certainly inversely proportional to one's degree of conviction about their supposed knowledge on the matter. Indeed, the construction of knowledge occurs in a specific sociocultural and historicist context, which conditions knowledge itself. At the same time, context is conditioned by knowledge.

Traditionally, rationalism, to the detriment of the primacy of emotions, has been considered since the 15th century as the most important achievement of the so-called "modernity". Let us remember Descartes' concept of *cogito ergo sum* in his *Discours de la Méthode,* 1637, undoubtedly influenced by Galileo's physics. In the most contemporaneous "postmodernity", called with this ambiguous term since the end of last century, there has been a great deal of

criticism toward extreme rationalism.[5,6] Postmodernity can be understood as a sort of new nihilism materialized as skepticism. In fact, thoughts, feelings and actions intertwined conform our personal existential reality. Therefore, from a gnoseological perspective, what is true may not be so for everyone.

Conversely, will and desire, which lead to action, are part of normalized ideology. One can rarely argue that ideology and polarization are usual realities in media systems all over the world. For a specific individual, the practical syllogism or rhetorical-dialectical argumentation justifying an action may not be necessary or unique. It suffices for that syllogism to be only possible or probable and contingent, even if it is based on false premises. Therefore, the specific action does not need to be the obligated or necessary consequence of said syllogism, even if it is to be expected.[7]

As is sufficiently known, the limbic system or midbrain, located underneath the cerebral cortex and above what Jakob called the visceral brain,[8] is composed of the thalamus, hypothalamus, hippocampus and amygdala. It is in constant and rapid interaction with the prefrontal and frontal lobes of the cortex. Long-term storage of information can rarely ever happen without the intervention of the hippocampus, which is highly correlated with the entorhinal, perirhinal, and parahippocampal cortices of the medial temporal lobe. These structures are commonly associated with memory and recognition. Fine mnemonic discrimination depends on the interaction between the cortex and the hippocampus.[9]

As previously mentioned, the Jakob-Papez circuit of the limbic system, also incorrectly called the Papez circuit, is crucial for the processing of emotions, memories and learning. The original name of the James Papez circuit since 1937, is “visceral brain”. That is how it was coined by its discoverer, the German neuropathologist Chrisfried Jakob. He documented it for the first time in 1908, and it was published in several important scientific media, both in German and in Spanish, since Jakob resided in the Argentine Republic.

The human ability to feel emotions is transcendental and is modeled within the cultural and historical context of each individual inserted in their own society.[10] Nowadays, we could also add the recent hypothesis of the different types of emotions, primary or social, with respect to their hemispheric lateralization.[11] That being said, learning and memory in particular require a whole amygdala. Dynamic changes in the modification of histones are also important during memory processes.[12] As is also known, histones provide structural support to chromosomes.

From a biological perspective, genomic medicine is a great contribution, as it studies the processes of health or illness from the interaction of our genes with the environment. Positive emotions, such as happiness and others, activate specific regions of the brain.[13] Hedonic feelings, unlike eudaimonic ones, which are associated with increased activity in the prefrontal cortex, usually guide behavior, affect decision making, induce learning, etc. Eudaimonic happiness, which is that of meaning and purpose, is projected on the long term, while hedonic happiness is more immediate and limited in time. These are central processes that accompany emotion, motivation and bodily states or conditions.[14]

Activation of the endogenous opioid system is consistently associated with emotions, and it modulates social bonding and affiliative behavior. In general, opioid agonists strengthen emotions oriented toward interpersonal bonds.[15] To conclude this subsection, it should be reminded that, when providing a vulnerable or resilient phenotype, allostatic processes, understood as they were proposed and described in 1988,[16] together with genetic polymorphism, exert a significant influence on the course and severity of substance use disorders or addictive behaviors.[17] Appart from that, to hide one’s own vulnerabilities can hinder the treatment.

● Mnemonic recovery, sexuality and fear

Reasonable avoidance of situations is an efficient protection mechanism. However, excessive generalization of fear to inoffensive stimuli implies a deficient adaptation. In some cases, that attitude will likely contribute to the appearance of an inadequate avoiding behaviour and of disorders related to anxiety and fear, as classified in ICD-11, the International Classification of Diseases for Mortality and Morbidity Statistics, codes 6B00-6B0Y. These disorders will result in an inability to face fear in an adaptive manner, as they cause cognitive, somatic and emotional symptoms, and often favor defensive-passive behaviors of escape or isolation.

Another issue is that brief, occasional acute stress does not seem to necessarily affect fear generalization,[18] although there are dissenting opinions, and this is certainly not the case if that acute stress is recurring. The effects of stress on young children's emotional memory, represented by the interaction between the amygdala and the hippocampus, differ by sex.[19] Emotional memory is understood as the learning, storage and recovery of events that have been associated to certain physiological responses. It has been suggested, among other matters, that there are sex differences in fear when conditioned mainly by memories.[20] This will be particularly relevant when it affects the psychology of judicial testimony.

With regard to sex, it should also be considered that the incidence of disorders associated with anxiety is substantially higher among women than men. Internal and external factors lead to epigenetic changes in key regions of the brain that are relevant to learning and memory. Epigenetics, as we all know, is the study of hereditary changes in the function of genes that cannot be attributed to alterations in the deoxyribonucleic acid, or DNA. These can also affect people differently based on sex. There are also occasional peculiarities with regard to mental health linked to intersexuality and transsexuality, which are frequent in the new social normalcy.[21] Furthermore, family socialization dynamics play an important role in the acquisition and retention of sexist conducts.[22]

Stress affects learning and memory,[23] and the effects of acute stress on memory encoding are particularly complex. "Stress" should be understood as an interaction between the characteristics of the stimulus and an individual's physical and mental coping mechanisms. "Coping mechanism" understood as the individual's personal combination of cognitive and behavioral efforts, as determined by Lazarus and Folkman in 1984, and that can be either active or passive. Implicit learning, intimately related to explicit learning, is difficult to manifest through language and is highly rigid, which makes it difficult to modify. It is usually unconscious and translates into several types of automatisms. On the other hand, it has been found that sustained stress induces similar effects to those of clinical depression, including social avoidance and anxious behavior.

Sometimes, an individual will make an effort to stop mnemonic recovery if unpleasant or unwanted memories appear. As partly discussed in the previous subsection, when an individual faces a situation of aversion or fear, the brain structures of the basolateral amygdala, the medial prefrontal cortex, nucleus accumbens and hippocampus are involved. These structures are greatly important for declarative or explicit memory, whether it be semantic or episodic. In fact, the bed nucleus of the stria terminalis in the amygdala is clearly involved in responses to stress. In a recent article, we also discussed the correlation of brain structures, neuroendocrinology, physiology, psychopathology, as well as genetics, gestation and molecular and immune activities that are related among themselves and also to experienced stress.[24]

Interrupting the recovery of a memory suppresses hippocampal and amygdala activity, which often occurs when perceived signals cause aversive memory intrusions.[25] Executive

mental functions depend on the content of controlled processes. This affects working memory, cognitive flexibility and thought inhibition, as is the case when intending to stop certain undesired mnemonic recovery. As a consequence, some personal differences in the coping style will be conditioned by anatomical-physiological idiosyncracies.

● Psychiatry, clinical psychology and social behavior

There are at least three factors that converge in all behaviors; the first two were described by E. Haeckel in the 19th century: 1) Phylogenetics, that is, the evolutionary and generic factor of the human species; 2) Ontogenetics or morpho-genetics, meaning personal genetic and maturational conditions; and 3) Epigenetics, which was discussed in the previous section. Here it is important to remember E. Erikson's psychosocial development theory and the factors that necessarily influence personality: internal factors (temperament, sex and genetics), and external (character, culture and gender).

Aggressiveness and violence can both be considered part of one same continuous and natural dimension. Aggressive behavior has been understood as a peculiar way of communication, which tends to adapt to scenarios in which the audience is perceived to lack empathy with the communicator's foundations and conduct.[26] However, the connection between empathy and aggress-iveness remains unclear. It seems that an initial empathy is inversely associated with a subsequent aggressiveness; while a reactive initial aggressiveness is inversely associated with a subsequent empathy.[27] An aggression that has already taken place may have been premeditated and oriented toward a goal, or it may have been impulsive, affective and reactive.[28] There is evidence that supports the specific involvement of the habenula in the neurocircuitry of aggressive behavior.[29]

Moreover, in emotional blackmail or mani-pulation, the threat is often to hurt or abandon a close person, and the goal is usually to induce fear or guilt in the recipient.[30] In turn, violence as a specific form of aggressiveness may be direct and personal or indirect. Environmental, psychosocial and biological factors interact modulating violent behavior. In relation to functional behavioral alterations, a study conducted on a sample of heterozygous mice has shown the progressive and cumulative impact that a deficiency in the AP2γ protein has on the hippocampal glutamatergic neurogenic process, as well as alterations on limbic-cortical connectivity.[31]

In any case, it would be relevant, when appropriate, to improve the training of criminal justice professionals working in the area of sexual violence.[32] Additionally, it is well demonstrated that sexuality, gender and certain mental disorders tend to be connected. It is also important that all medical staff involved in discerning about sexual consent of minors be optimally trained.[33]

● Conclusions

Specialized scientific literature has noted the importance of the integrated combination of knowledge, confidence and persuasion, while taking into account the individual's limits of understanding and their cognitive bias. In the recently called postmodern culture of the current new normality, skepticism is emphasized and applied to nearly all fields. In the convergence between cultural heritage and neuroanatomical and psychological knowledge, truth is just an opinion, and not an unquestionable or objective reality.

In effect, will, beliefs and desires, integrated in the ideological field, rationalize, explain or condition most behaviors. Preference or intention determine our resolutions. Emotion is part of the social development of personality and at the same time, it is intimately linked to motivation and necessity. Anatomically, the thalamus, hypothalamus, hippocampus and amygdala are particularly involved and in immediate and constant interaction with the prefrontal and frontal lobes of the cerebral

cortex. In particular, the bed nucleus of the stria terminalis in the amygdale is clearly involved in responses to stress and in states of anxiety, in general. Obviously, stress exposure can cause profound changes in physiology and behavior, especially social.

In any case, aggressiveness and violence can both be considered parts of one same continuous and natural dimension. Violence, as an exacerbated form of aggressiveness can either be direct and personal or indirect. There are appropriate pharmacological and non-pharmacological treatments for these often disruptive types of behavior. The effects of acute stress in memory encoding are complex. This will be particularly relevant when it affects the psychology of judicial testimony. Better training of criminal justice professionals working in the field of aggressive behaviors, understood in broad terms, is also necessary, and more particularly for those working in the field of sexual violence.

Conflicts of Interest: None

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Ethical Considerations: All the pertinent ethical norms have been respected.

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