



Understanding Emotional Roots of Human Immune System

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Abstract

Decades of research has provided evidence that various psychological factors have a huge impact over the immune system which systematically stimulate it to give positive or negative responses and can time to time show several levels of modulations. These modulations or responses may enhance or may adversely affect the immune function of an individual.

This review article focuses on affects and its roots to the human immune system, supported by various studies conducted in different times. The paper also discusses all the possible pathways by which emotion can connect with the immune function and vice-versa, how stress can affect the immune response as well as how the elements of psychological factors can modulate the immune function of an individual.

Keywords: Human Immune System; Emotions; Immunology

Introduction

The revolutionary article by Solomon, et al. [1] Emotions, Immunity and Disease- A Speculative Theoretical Interpretation"- pioneered the concept of "Affective Immunology" in scientific world. The article attempted to discuss about the theoretical foundation of the integrational relationship between the psychological factors (stress and affect or emotion); immune function and dysfunction and has coined the term "Psychoimmunology" for affective immunology. Regardless of this significant theoretical paper, only handful of human research has been conducted till the date. However, ensuing exponential growth in the human research has provided evidence of existing psychologically mediated immune responses and modulations in them.

The Affect (Emotion)

Affect is a perplexing, variable and is considered as a cyclic process. The expression "affect" is interpretation of the

Latin term "affectus", which can be deciphered as "passion" or "emotion." Rorty, et al. [2] has shown that there are historically recorded changes in the scientific categorizations of the key feelings, affects, wants, or desires, and passion; these are the terms that are utilized interchangeably in shifting interpretations from Greek and Latin until the late nineteenth and twentieth centuries, when "passion" got reserved for sexual roles and genuine responsibility, and "want or desire" was isolated from "affect". However, similar terms-love or like, lust, hate or dislike, outrage or anger, jealousy or envy, disgrace, or guilt- proceed in proof from antiquated occasions to the present; they are found in old Greek scientific taxonomies of the emotions, before that in Egyptian and Hebrew arrangements of demons, and proceed through to Freud, et al. and after.

The primary philosophical text of the subject- Aristotle's Rhetoric, et al. [3] coordinated the affects regarding "grace and disgrace, love and contempt, fear and confidence, shame and respect, graciousness and heartlessness, pity and ire,

jealousy and emulations. Present definitions of the affect or emotion stem primarily from Darwin's physiological record of the emotion and are referred to as the William James-Carl Lange theory. In their theory, James, et al. has principally directed that physiological state leads to affective states. This is notably provided by simulations, for example, "crying makes us sad," in spite of the fact that for William James the issue was undeniably more nuanced. It was mistaken that there were genuine contrasts among James and Lange, particularly concerning James' familiarity with the external variables impacting the emotional state while Lange reinterpreted the theory by operationalizing it.

Affect has been hypothesized in two prevailing perspectives. The primary view point has its foundations in psychology and neuroscience, inclined to view "Affect as an elemental state". Subsequently, this practice is reflected in Tomkins' theory, et al. [4] of primary affects and Damasio's, et al. [5] theory of basic emotions. Ongoing expansions on this practice incorporate the work by Brennan, et al. [6]. The subsequent point of view is commonly associated with advancements in field of philosophy, human behavior and the humanities, regards "Affect as an Intensive Force". This practice is evident in Masumi's, et al. [7,8] theory of autonomous affects and Thrift's, et al. [9] non-representational theory, whose most well-known supporter is Deleuze, et al. [10].

The Immune System

Initially immune system revelations were generally strengthened by a desire to prevent the spread of infection and grow better therapies for the incapacitated individuals. The immune system is represented as a physiological arrangement of resistance. Term immune is derived from the Latin word in and munia signifies not committed to support or not obligated to service." Roman residents, especially male people were obliged to participate in specific obligations related with the state. The immune individuals were excluded from this service. At that point, to be immune intends to be liberated from what is viewed as a characteristic outcome of associating with something that could be greater than one self. For the individual life form, to be essential for the universally accepted articulation of Life, an individual should be exposed to the potential for harm for their efficient survival. Thus, immune is the condition where an individual is away from the potential natural consequences of vulnerability. Therefore, the immune system is an arrangement of protection rather than array of resistance. More precisely, it manages and directs the behavioral responses related to self-versus non-self-elements, friend versus antagonist elements of behavior, which subordinate four essential immune functions: vigilance, resistance, protection, and attack.

In the subsequent time, the requisite for the immune system emergence has resulted out of the necessity of exposing every closed system to its surroundings. The immune system is a perplexing organization of innate and adaptive immunity including both humoral or fluid and cellular parts. This isn't essential for a "super-system" yet a receptive methodology utilized by the integrated complex of neural and endocrinal system, as the administrator for effective functioning; thereby, managing the structure and function of the system and showing receptiveness to hepato-pancreatic competency. Moving towards immunity from a comprehensive systems viewpoint, it offers a more noteworthy complexity and scope to the assessment and treatment of ailments.

Association of Emotions, Immune and Other Physical Systems

Psychological factors are identified as underpinning the immune function of an individual. Emotions and immune processes are interlinked in such a manner that they can be followed back to relics. However, the rational of mechanisms underlying these processes have recently been revealed, greatly due to the investigation of Selye, et al. and his associates. They have showed that the pituitary gland and the hypothalamus plays a vital role in controlling the release of stress hormones, specifically the glucocorticoids, which help the body to regulate with external and internal stressors but moreover have a role in regulating immune functions. Consequently, it was revealed that the immune transmitters, the cytokines, and concerned secretory Components from immune cells can interconnect with the endocrinal and central nervous systems to modulate their functional capacities. It is currently perceived that the endocrinal-Immune system and the brain are functionally linked to give an organized reaction to external and internal stressors. This network is additionally connected to the central and peripheral supportive systems, thereby giving a structure whereby the nervous system can precisely influence the function of the immune system by stimulating adrenoceptors that are situated on immune cells. Affective immunology also termed as Psycho-neuro-endocrine-immunology has developed into an exceptional discipline for studying the psycho-immune-endocrine-neuro-behavioral network in depth.

In the course of recent years, evidence has accumulated on the nature of the interactions between the central sympathetic and the immune system. This Immune system is auto regulated, that is, immune cells recognize normal cells as the cells that belongs to the body of a particular person from foreign (unknown to a person's body) cells so that escalating an immune reaction against antigens does not need a significant involvement from the cerebrum.

Nonetheless, it is evident that the cerebrum plays a significant role in regulating the function of the immune system and, on the other hand, the immune system plays a vital role in the symptoms of patients experiencing major mental disorders such as schizophrenia, depression, and anxiety disorders. Thus, in the broad view the Immune system is principally an auto regulated procedure which concern about protection of the body counter to irresistible illnesses, it is currently evident that there is consistent 'cross-talk' between the psychological, endocrine, immune, and neural system.

The Crosstalk between Emotional Responses and Immunological Responses

Emotional reactions are elements of complex interactions of body functions that influence ability of the human body, either to stay in healthy state or to be protected or to confront ailment or to fight infection. Health improving and health hindering practices, comprising diet, sedentary lifestyle, exercise or physical activeness, smoking, and protection from exposure to harmful ecological elements can compromise health or profit health. It is evident that inherited and behavioral factors are integrated with health, in compound ways proceed to mount, and information about these impacts has consequences for clinical (psychiatric) results and essential health care routine. Evidence through experiments is yet conflicting however; data collected from investigations of health and behavior recommends that an individuals' emotional states impact the etiology and progression of infection and additionally to have endurance or vulnerability to disease.

Generally, psychological or behavior factors exerts their impact on health or ailment in three essential manners-direct biological changes, genetic factor-based impacts and environmental factor-based modulations [11]. The findings from the experiment of Kiecolt-Glaser et. al. (1994), has been revealed that stress results in elevation in level of blood pressure, sympathetic stimulation and heart rate, and is also related with changes hematological values contributing precisely to hypertension, coronary disorders, or cardiac events. Regardless of whether the immune system changes are strong or weak enough to heighten susceptibility towards infection or ailment isn't clear, however they have been ensnared in the causative factors and wound recovering, progression of viral infections and malignant growth [12].

Watanuki, et al. [13] were engaged in smartly devised research on the physical and functional responses stimulated by pleasurable inducements. Results of the research studied various physiological responses of the central nervous system, immune system, endocrine system, and autonomic nervous system when pleasant stimulus, like smells, expressive images was presented to subjects of the study. The

outcomes uncovered that electroencephalogram movements of the left frontal cortex were improved by a pleasing odor, thereby affecting positive emotions and an increased level of secretory immunoglobulin-A and linguistic pleasant emotion were induces a decreased level of salivary cortisol. Various systems were found to be associated with the introduction of pleasant emotions and are induced by central nervous system self-stimulus and especially the inducement system. Structurally the central brain position strongly related with the inducement system is in the middle of forebrain bundle. The amygdala complex shows complexly linked fiber networks with the inducement system and results into the input and output of the system. Subsequently, the amygdala performs the role as the center for coordinating pleasant emotions. The amygdala separates all sensory system of tangible inputs and distinguishes stimuli significant for the body while the hypothalamus plays a vital role in emotional articulation.

At the point when corticotrophin releasing hormones are emitted from the nerve center (hypothalamus), catecholamine's and cortisol are next to be discharged from the adrenal glands via pituitary glands, both secretions are from the hypothalamus-pituitary-adrenal and sympathetic adrenomedullary axes. Functioning of the pituitary-adrenal-hypothalamus system can be observed by the salivary cortisol levels, while those of the sympathetic adrenomedullary system can be assessed by the functioning of heart. As secretory immunoglobulin, a parameter of immune systems' action is strongly related with pituitary-adrenal-hypothalamus systems, its levels should be also estimated time to time. The innovative examination by Watanuki, et al. [13] focused on the impacts of pleasant feelings activated by visual, linguistic and olfactory stimuli on functional response of body.

It is evidently perceived that the stress has a significantly greater impact on the immune system through characteristic emotional and/or behavioral manifestations, including anxiety, stress, outrage, fear and anger and major physiological changes such as pulse, blood pressure, and perspiration [14]. Investigators have proposed that these progressions are advantageous to the body only if they are for a short span of time; however, when stress is persistent, the body system becomes incompetent to sustain equilibrium state or homeostasis and the body shows the prolonged state of excitement, where digestion is observed being slower than usual to reactivate or rather does not participate in the reactivation appropriately, resulting into heartburn. Furthermore, blood pressure continues to elevate [15].

Decades of research have revealed that the meta-analysis has shown a consistent immune dysregulation in healthy individuals undergoing the acute/ chronic stress

conditions. In the first phase of meta-analysis performed by Herbert, et al. [16] observed 38 studies of distressing events and immune system in healthy individuals. The study included investigations of consistent laboratory stressors such as speech or linguistic task and momentary naturalistic stressors like clinical examinations, and long-term naturalistic stressors such as separation, deprivation, caregiving, and unemployment. The findings have revealed that stress-related components have increased in the number of white blood cells, furthermore, decrease in the number of the antigen representing cells such as T-helper lymphocytes (CD4⁺), T-cytotoxic lymphocytes (CD8⁺), T-suppressor/regulatory lymphocytes (Treg cells), B-cells, Natural Killer lymphocytes (NK). It also observed the stress-related declines in number of Natural Killer cells and stress-related inability to restore the immune functions in the studied individuals. These impacts were predictable for short and long-term naturalistic stressors; however, no similar results were obtained in the case of laboratory stressors.

Zorrilla, et al. [17] successfully replicated Herbert, et al. [16] first phase of meta-analysis. They utilized similar research design and selection procedures as of Herbert and Cohen and they explored 75 results related to stressors and human immunity. Naturalistic stressors were related with increase in number of circulating neutrophils and decrease in number and percentages of total T-cells and helper T-cells, Natural Killer (NK) cells and cytotoxic T-cell lymphocytes [18-20].

Conclusion

A well-functioning immune system is vital to sound health [21]. Maladaptive immunological modulations may impact the etiology, progressions, and additionally severity of various ailments; though irresistible infections, certain malignancies, wound healing, and immune dysfunctioning has been observed time to time. Given the emphasis, it isn't astonishing that psychological conditions that impact immune function can give rise to many complications for health. The field of affective immunology in future would help us to understand these complications and can generate promising coping strategies.

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