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LINKING SOCIAL STRESS, HEALTH AND SOCIAL BEHAVIOR THROUGH THE LENS OF EVOLUTION

Stress has been systematically shown to affect health. Social life introduces additional sources of stress, and social stressors emerge as a particular kind of stressors. Living in groups and embedded into their social networks, humans live a complex life based on regular social interactions, elaborate cultural routines and mental life rooted in intersubjectivity, capacity for social learning and affiliative needs. Social Safety Theory and life history orientation approach use this ground to develop an evolutionary-based perspective on life stress and health. While life history orientation framework is already well established in social epidemiology, medical anthropology and sociology, Social Safety Theory is a novel approach building on the psychological ability embedded in human sociality to form and maintain lasting social bonds. It hypothesizes that threats to social safety are a critical feature of psychological stressors that increase risk for disease. By doing so it provides a link between social behavior, psychosocial stress and human health when considered in the light of evolution. Life history orientation approach stems from the evolutionary premises and expands its biologically-grounded reasoning into the realm of psychology as well as health sciences. Among other things, it contributes to sociological frameworks linking the effects of childhood adversity to patterns of disease and social behavior in adult life. Both these frameworks provide important conceptual junctures for the researchers of stress, health and social behavior by developing explanations of different avenues by which our social ecologies affect biological risks.

Keywords: affiliation, evolution, stress, inflammation, health, disease, evolutionary mismatch, Social Safety Theory, life history orientation.

The new perspectives offered by the evolutionary argument

The past is not dead. It is not even past.
(William Faulkner *Requiem for a Nun*)

Stress has been systematically shown to affect health outcomes (Segerstrom & O'Connor, 2012; Thoits, 2010). As it is often observed, stress is an inherent element of biological life. It is also justly observed that nothing in medicine makes sense but in the light of evolution (Varki, 2012). The evolutionary perspective allows a more nuanced take on the question: *What is health?* (Sterling, 2021). The adaptationist[1] approach to stress offers new insights into the important dimensions of interactions between the social and the physiological, revealing not only the harmful effects of psychosocial stress on human physiology, but also their pathways and sources. There is a rich literature on the biology of stress that is being gradually incorporated into the social research on health and illness. Stress process is no longer viewed as uniformly negative or destructive, nor all stressors are viewed as equal in their ability to compromise or damage health. The organism's biologically evolved stress response is understood as one of the key adaptations that is deployed to counter the demanding circumstances by promptly producing a number of physiological changes in an organism to help conquer the situation or escape its consequences. Furthermore, the stress response is understood to be an evolved adaptive reaction that marshals the organism's resources in a crisis and enhances its chances for survival. For example, stress represses hunger, moderates the feeling of pain, reduces the production of sex hormones decreasing chances of reproduction in both males and females, etc. Thus it is also a costly adaptation as it involves a cost-intensive process of mobilization of the organism's resources to address the stressful situation by fighting or fleeing it and then restoring the system to the balanced state (homeostasis) which constitutes the additional strain on the organism's physiological systems. The modern scholarship recognizes the adaptive value of stress and its connections to the immunity, inflammation and chronic conditions that are central to the epidemiological profile of modern societies. In that sense, the evolutionary perspective on stress allows us to see the dynamic interrelations between

[1] Adaptationist theorizing is informed by the premises of the evolutionary theory and principles of modern biological sciences.

the social and physiological factors in all their complexity.

The effects of the social environment in human health belong to one of the most well-studied areas in social and health sciences (Slavich, 2020; Sterling, 2021). Humans are characterized as an ultra-social species (Tomasello, 2014). Living in groups and being embedded in our social networks, we share a complex life based on regular social interactions, elaborate cultural routine and mental activity rooted in intersubjectivity, capacity for social learning and affiliative needs. Social ties provide social support and enable abilities such as social cognition and social emotions. Social perception, social comparison and similar faculties enhance social intelligence but they also make us more vulnerable by opening us up to the pernicious effects of stressors residing in the social fabric, including demanding social roles, strict normative prescriptions and standards, hierarchies, etc. Social life introduces additional sources of stress, and social stressors emerge as a particular kind of stressors.

Living in a modern society also introduces a number of additional stressors associated with new challenges of the social reality that has emerged as a consequence of the Neolithic revolution, including those that did not exist in the ancestral environment where most human adaptations (including stress response) have evolved (Brenner et al., 2015; Katsampouris, Turner-Cobb, Barnett, & Arnold, 2020). The most essential of these shifts include change in diet and sleeping patterns, social organization (larger and more anonymous groups, less security of one's social position, less clear social roles, less certain career choice, the emergence of undesirable social/professional roles, etc.), social relationships (alienation, separation from family, smaller role of kinship, etc.) (Schreier & Evans, 2003). Furthermore, not only are our social ecologies different from those inhabited by our ancestors (including, for example, dead-end jobs, utility payments, taxation, inefficient bureaucracies, etc.), but they also engender the kinds of stressors that are less life-threatening but still use the same neurological mechanism by which the costly mobilization occurs (Hughes, Steffen, & Thayer, 2018; Katsampouris, Turner-Cobb, Barnett, & Arnold, 2020; Slavich, 2019). In other words, although the stress response is adaptive per se, its adaptive value (the payoff) is not present outside the ancestral environment[2], thus potentially affecting the taxing task of keeping the balance between the problems that we have or have not adapted to solve (the 'evolutionary mismatch') (Brenner et al., 2015).

The adaptationist approach is useful here for several reasons. On the one hand, the evolutionary arguments offer new horizons for the research on stress and health. Given this reason, the goals of the present paper include presenting the synthesis of the biologically-based adaptationist ideas that can be effectively incorporated into the sociological account of the stress-health link. On the other hand, social stressors are often chronic and impactful, but not all of them damage health and their impactfulness varies in degree. Although the effects of chronic stressors in health outcomes have received much research attention, the mechanisms by which the "wear-and-tear" process occurs in the organism and the factors that could slow down (if not reverse or prevent) this process are still not fully understood (Goldstein & McEwen, 2002). That is why an additional goal of this paper includes introducing our readership to the range of theoretical frameworks providing a balanced account of why it is so. I begin by presenting the current conceptualization of stress and its important dimensions. The discussion then transitions to the notion of stressors and their differential impact on human physiology. Then I proceed to sketching the important conceptual connections between stress and immunity and why it matters for a living organism. Finally, the role of psychosocial stress in health outcomes is addressed and the two theoretical perspectives that engage with its causal pathways linking stress and health in the adaptationist context are introduced. Specifically, this paper reviews two interesting and useful theoretical approaches that are relevant to sociology of health – Social Safety Theory and life history orientation approach. The two theories are quite different in their scope, origins and intellectual goals. However, they both embrace the premises of the allostasis theory, specifically with respect to what chronic stress does to health and the main pathways by which stress can affect health. Life history orientation approach is chronologically older and is therefore more widely known and applied by social scientists. It has deep roots in evolutionary biology and can be traced directly to population biology research. It has interesting insights into the links existing between the early years (childhood) adversity and the development of aversive traits (the Dark Triad, etc.) and dysfunctional behavioral patterns (impulsivity, etc.) that are relevant to health in later life.

In its turn, Social Safety Theory is more recent and comes from a more social-science informed

[2] Most adaptations are locally specific and do not work outside of the environment for which it has been evolved.

theoretical background being an integrated framework rather than a singular idea. It is based on the biological reasoning merging the physiological changes associated with stress response (i.e. launching an anticipatory inflammatory response) to social threats with the logic of adaptation. A principal role in this explanatory framework is given to the human feature of prosociality (resulting in a motivation for friendly, cooperative, helpful behavior). Over the course of evolution, individuals who fostered greater social safety (cultivated friendly bonds and avoided conflicts) and who mounted anticipatory inflammatory responses to social threat were most likely to survive and have offspring. Consequently, a drive to develop friendly social bonds, and to mount a systemic inflammatory response to social cues indicating an increased risk of physical danger, was likely a feature to be selected for (Slavich, 2020, p. 287). Social Safety Theory is also based on the grounds of the allostasis theory and builds on its argument that stress – when chronic and systematic – compromises immunity. In this context Social Safety Theory urges to consider several factors that can alter the activity of the social signal transduction pathways that shape experiences of social safety, e.g., genetics, sleep, childhood microbial environment, diet, birth cohort, air pollution, and self-harm behavior (Slavich, 2020, p. 288). This framework offers a biopsychosocial mechanism by which stress contributes to accelerated aging, health disparities and dysfunctional (maladaptive) behavioral and psychological traits.

Stress and stressors

In present day biomedical research *stress* is conceptualized as a situation when the environmental demands are perceived as taxing or otherwise exceeding the resources available to the organism in order to deal with these challenging demands (Cohen, Janicki-Deverts, & Miller 2007; Katsampouris, Turner-Cobb, Barnett, & Arnold, 2020; Lazarus, 1999; McEwen, 2019). Stress literature typically distinguishes between different kinds of stress (and, therefore, different kinds of associated stressors). Although there are as many as five types of stressors based on their onset and duration patterns (Segerstrom & Miller, 2004, pp. 602–605), ordinarily empirical research splits the stressful experiences into two large categories labeling them acute and chronic stressors to emphasize the time frame of the exposure to stressful events. Both acute and chronic forms of stress have been shown to have negative consequences for health (Rohner, Bernays, Maercker, & Thoma, 2021). For example, both acute (e.g., public speaking, taking an academic test, visiting a dentist, having a surgery, etc.) and chronic stressors (e.g., low SES, childhood adversity, facing taxing requirements embedded in gender roles, being in a demanding social position, caring for a chronically ill person, being in an abusive relationship, etc.) are cited as risk factors for developing mental disorders (Cristóbal-Narváez, Haro, & Koyanagi, 2020; Keyes, Hatzenbuehler, & Hasin, 2011; Rohner, Bernays, Maercker, & Thoma, 2021). Acute and chronic stressors being part of adversary life circumstances have also been linked to negative physiological outcomes, including conditions such as arthritis, asthma, Alzheimer's disease, fibromyalgia, obesity, cardiovascular disease, and diabetes (Chen et al., 2009; Langgartner, Lowry, & Reber, 2018; Marmot, 2018; Miller, Chen, Fok, Walker, Lim, & Nicholls, 2009; Murray, Haselton, Fales, & Cole, 2019; Rohner, Bernays, Maercker, & Thoma, 2021; Slavich, 2015; Soares, López-Cheda, Santos, Barros, & Fraga, 2020).

As our knowledge about stress has expanded over the past few decades, so has our understanding of stress physiology (Cole, 2010; McEwen, 2019). Modern day stress research builds extensively on data acquired within the biological sciences and specifically on findings from research in evolutionary biology and sociogenomics (Cole, 2010). Gradually this information becomes integrated into the social sciences research on stress. As a result of these changes, presently stress is viewed as an ongoing adaptive process rather than a singular and necessarily pernicious event, and also as an experience with a potential for prognosis and learning to avoid threats (Kiecolt-Glaser, Renna, Shrout, & Madison, 2020; McEwen & Akil, 2020; Turner et al., 2020). This change is important in that it effectively brings to light the role of the organism's reaction to the stressor (subjective interpretation) rather than focus solely on the stress exposure *per se* (objective event).

The importance of considering the *interpretative* aspect of stress has been emphasized by the pioneers of stress research in social sciences such as Leonard Pearlin and his students and followers (McLeod, 2012; Pearlin, 1989; Schieman, 2019). Following the introduction of the stress process model by Pearlin, those social scientists who have contributed to the research on stress in medical sociology have been speaking of the impracticality of studying stress without taking into account its cognitive dimension (Lazarus & Folkman, 1984; McLeod, 2012; Pearlin, 1989; Reynolds & Turner, 2008).

Stressful elements can be part of one's environment (i.e. external to individual), or one's evaluation[3] of the situation/event (i.e. internal to individual), or one's reaction to a situation (first of all, emotional and physiological responses), but they should not be equated with one another when assessed and measured (Segerstrom & O'Connor, 2012). Therefore, in terms of conceptualization and operationalization for measurement, the perception of stress, or subjective stress, is a parameter that should be carefully considered if we wish to explain causal relationships between stress and health.

Another important aspect of conceptualizing the links between stress and health is considering the distinctions between such factors as stress *exposure*, stressful situation *evaluation* and stress *response* (McLeod, 2012; Pearlin, 1989; Schieman, 2019). Ignoring this distinction introduces the risk of equating stress exposure to stress response and potentially projecting the stress-related health outcomes onto all instances of stress exposure. However, not all stressful events have the same impact on different individuals, and individuals differ among themselves with respect to both their stress resistance and resilience (McEwen, 2019).

The stress process dynamics combines the *external* factors (i.e., stressors) with the resulting *internal* experiences of tension or strain. The degree of impact of a stressor depends on various factors in the individual's background, including culturally conditioned details of life history and social experience, socio-economic situation, individual differences such as personality traits, etc. The empirical findings in the domain of stress research have thus shifted the theoretical lens from the material aspect of stressors to the cognitive component of evaluation and interpretation of the situation as experienced by an individual (Christensen et al., 2019; Cundiff, Boylan, & Muscatell, 2020; Kiecolt-Glaser, Renna, Shrout, & Madison, 2020; McLeod, 2012; Segerstrom & O'Connor, 2012). Stress is generated when an individual's assessment of the situation presents the demands of the situation as taxing or in some way exceeding the resources available to the individual to cope and re-adjust the balance (Cohen, Janicki-Deverts, & Miller, 2007; Katsampouris et al., 2020; Lazarus, 1999; McEwen, 2019; Schieman, 2019). The perception component becomes even more important when considered in the context of adaptation (Mullainathan & Shafir, 2013).

[3] That can be subject to sociocultural regulations, normative culture being one of the chronic stressors providing both the societal standards of behavior and the criteria by which individuals judge others and themselves within a sociocultural community.

Stress response and the allostatic load

This reasoning also presents the stress response as a costly process of balancing the allostatic load[4] (McEwen & Stellar, 1993). Stress physiology is associated with considerable energy expenditure due to the processes involved. In this context there are two main physiological pathways by which stress can affect the human body. The first pathway is associated with the coordinated functioning of hypothalamus, pituitary gland and adrenal gland[5] the result of which is the production of catecholamines, e.g., adrenalin. This pathway overarches a broad range of physiological processes and regulates the inflammatory reaction, metabolic break-down of fats and carbohydrates, and production of glucose. The second pathway is related to the functioning of the sympathetic nervous system, adrenal gland and medulla[6], and its activation results in production of cortison (Cohen, Janicki-Deverts, & Miller, 2007). This second pathway regulates cardiovascular and respiratory systems, skeletal muscles and also the immune system. Chronic activation of both these channels increases the allostatic load which can dysregulate their normal functioning, thus leading to the increased risk of physical and mental disorders via systemic inflammation (Cohen, Janicki-Deverts, & Miller, 2007, p. 1685; Kiecolt-Glaser, Renna, Shrout, & Madison, 2020; McEwen & Akil, 2020; Slavich & Irwin, 2014; Turner et al., 2020). This is the important point ensuing from the allostasis theory. Therefore, while stress response has adaptive value due to the fact that it increases the organism's chances of survival, regular stress builds up the allostatic load and wears out the immune system thus leading to maladaptive consequences.

Guided by the allostasis theory, our current understanding of stress physiology is based on the premise that stress response is adaptive as it enables an organism to transition from the state of homeostasis through mobilization to stress and back again. Yet this adaptive mechanism comes at a price, as rallying the organism's resources is a highly costly, energy-consuming process. Systematic increase in the allostatic load is harmful to health and can endanger the immune function of an organism (Goldstein & McEwen, 2002;

[4] Allostasis is a process of reversing the physiological changes brought about by the stress response back to the normal state (i.e. homeostasis). The term "allostatic load" sums up the total of cumulative adjustments that were necessary for coping with stress over the life course and adapting to the demands of systematically changing one's status from stress to homeostasis and generally indicates how difficult one's life is (McEwen & Stellar, 1993).

[5] Hypothalamic-pituitary-adrenocortical axis (HPA).

[6] Sympathetic-adrenal-medullary system (SAM).

Kiecolt-Glaser et al., 2020). In modern societies the condition of chronic stress is associated with inflammatory processes, allergic reactions and autoimmune diseases (Brenner et al., 2015; Furman et al., 2019; Lasselin et al., 2020). The link between stress and disease has been formulated in the 19th century; since then the body of empirical evidence attesting to the pernicious effects of psychosocial stress in human health and well-being has grown (Berkman, Glymour, & Kawachi, 2014; Brenner et al., 2015; Cohen, Janicki-Deverts, & Miller, 2007; Cundiff, Boylan, & Muscatell, 2020; Lasselin et al., 2020; Miller, Chen, & Parker, 2011; McEwen, 2007, 2019). Systematic encounters with stressors or chronic stress can lead to pathological outcomes due to the heightened allostatic load, including impairment of cognitive, development and organism's growth processes and harm to reproductive and immune systems (Kiecolt-Glaser, Renna, Shrout, & Madison, 2020; McEwen & Akil, 2020; Turner et al., 2020).

Based on the results from the research on psychophysiology of stress, social immunology, neuroimmunology and specifically the studies of the allostasis process the biological pathways linking social conditions and important health outcomes have been identified, implicating such conditions as low socioeconomic status in early years of life, childhood adversity and traumatizing experiences in the onset of deleterious health outcomes (Adler et al., 1994; Bosch et al., 2012; Chen, Miller, Kobor, & Cole, 2010; Cohen, Doyle, Turner, Alper, & Skoner, 2004; Cole, 2010, 2013, 2014; Cole et al., 2007; Cole, Shanahan, Gaydosh, & Harris, 2020; Irwin, & Cole, 2011; Kawachi & Kennedy, 1999; Kiecolt-Glaser, Marucha, Malarkey, Mercado, & Glaser, 1995; Kiecolt-Glaser, 1999; Marmot & Bell, 2019; McDade et al., 2019; Miller et al., 2009; Chen et al., 2009; Murray, Haselton, Fales, & Cole, 2019; Slavich & Cole, 2013; Tawakol et al., 2019; Yang et al., 2017). There is systematic empirical evidence that social ecology affects human health. One of the most active research tangents being developed in this research niche now is establishing the possible avenues for buffering or reversing the destructive effects of stress on health (Epel et al., 2018; McEwan, 2019; Cohen, Murphy, & Prather, 2018; Fitzgerald et al., 2021; Turner et al., 2020).

Stress, immune response and evolution

Although the links between stress and health are well developed, very little attention is allocated to incorporating the evolutionary dimension of the stress process and the causal connections that it has with health and well-being, including the development of psychopathology (Andrews et al., 2020; Nesse, 2000).

Stress response is an adaptation that is phylogenetically old (Cole, 2010; Ice & James, 2012; Fink, 2017; Slavich, 2016; Walker, Pfingst, Carnevali, Sgoifo, & Nalivaiko, 2017). Stress response mobilizes the resources available to the organism to prepare it for the upcoming crisis (Brenner et al., 2015, p. 1), and in that sense stress response is connected to the immune response (Slavich & Irwin, 2014). Immune response is a highly costly process (Barton, 2008). Having a feature that provides a prompt reaction to the external threats is evolutionarily beneficial as it improves individual chances of survival, reaching the reproductive age and producing an offspring. Therefore, those physiological reactions that support an organism's ability to be efficient in responding and adjusting to environmental challenges (predation, natural disaster, physical attack or pathogen threats) can be expected to be selected for as potentially adaptive (Barton, 2008; Segerstrom & Miller, 2004). "A little stress" during a brief interval of time serves the purpose of regulating the balance. It is adaptive in a short-term defense scenario.

However, a stress response cannot be a long-term defense in terms of immune function and if activated on a systematic basis can lead to negative health outcomes (Slavich & Irwin, 2014). Both the innate and specialized immune responses work to protect the organism against a threat (external ecological changes or introduction of a pathogen) by mobilizing the organism's resources and repress other needs and physiological systems (Beurel, Toups, & Nemeroff, 2020). The mobilization of the organism to deal with the threat brings upon the physiological changes that occur quickly (with immediate effect within seconds in case of the innate immune response which is a generalized inflammatory reaction or within hours in case of a more specialized immune response that is based on the deployment of the mechanisms that are more pathogen-specific) (Barton, 2008; Beurel, Toups, & Nemeroff, 2020, p. 2; Slavich & Irwin, 2014, p. 775). After the normal stress response is over, the organism expects the transition to homeostasis. Yet if the stress is systematic or chronic, the homeostasis becomes less achievable while the toll of allostatic changes is considerable. Systematic stress can damage the functioning of an organism's important physiological systems or dysregulate the immune function leading to higher vulnerability to infections and poorer response to vaccines (Furman et al., 2019, p. 1823). This factor is also cited as implicated

in the connection between the stress, inflammation and immunosenescence, and its role in the prevalence of chronic conditions in the modern epidemiological profile is broadly discussed by the social epidemiologists and medical sociologists (Segerstrom & Miller, 2004).

Despite the generally adaptive characteristics of the stress response, the types of stressors we encounter in modern societies differ markedly in their nature from those that the ancestral human groups had to face at the time when major relevant human adaptations were formed[7], as discussed earlier (Bennett, Reeves, Billman, & Sturmberg, 2018; Brenner et al., 2015). In the past when occurrences such as predation, starvation or natural disasters were more imminent, having a costly mechanism for avoiding life-threatening situations was justified. In modern societies the new stressors have emerged while these events became a less likely stressor. Nonetheless, the nature of an adaptation being conservative, humans are bound to our metabolically costly stress response strategy in situations that are less life-threatening (traffic jams, check-out lines, inefficient bureaucracies, broken elevators, etc.) but add cumulatively to the allostatic load nonetheless (Katsampouris, Turner-Cobb, Barnett, & Arnold, 2020).

The evolutionary perspective associates these results with the changes in lifestyle and the nature of stressors that modern societies face compared to the ancestral human groups where the stress response has initially evolved. More specifically, the researchers often cite the decrease in the security of one's social position, lower certainty of professional choice, the emergence of undesirable social and professional roles, as well as changes in circadian rhythm, separation from the kin group and having to interact with a greater number of strangers than thousands of years ago (Brenner et al., 2015, pp. 2–3). What is more, despite the adaptive nature of the stress response, the adaptive value of this adaptation has declined as the ancestral environment to which it was an adaptation is no longer present in the living conditions of modern societies. This "evolutionary mismatch" can create an imbalance between the evolutionary tasks that humans have been facing then and had to adapt to, and the new ones that we still have to figure out how to adapt to (Brenner et al., 2015; Katsampouris et al., 2020). In this context it is often observed that the stressors that are currently prevalent in modern societies are markedly different from the social ecology of the ancestral human groups when most of the current adaptations have been formed (Bennett, Reeves, Billman, & Sturmberg, 2018; Brenner et al., 2015). The social-evolutionary approach to stress and disease thus emphasizes the importance of the refinement of our understanding of various adaptive mechanisms to understand health outcomes (Goldstein & McEwen, 2002; Katsampouris et al., 2020).

[7] Including the stress response itself.

Psychosocial stress and health

Research into psychophysiology of stress, neuroimmunology and allostasis offers insights into risk factors as well as biological pathways linking social conditions to the important health outcomes (Adler et al., 1994; Bosch et al., 2012; Chen, Miller, Kobor, & Cole, 2010; Cohen, Doyle, Turner, Alper, & Skoner, 2004; Cole, 2010; 2013, 2014; Cole et al., 2007; Cole, Shanahan, Gaydosh, & Harris, 2020; Irwin & Cole, 2011; Kawachi & Kennedy, 1999; Kiecolt-Glaser, Marucha, Malarkey, Mercado, & Glaser, 1995; Kiecolt-Glaser, 1999; Marmot & Bell, 2019; McDade et al., 2019; Miller et al., 2009; Chen et al., 2009; Murray, Haselton, Fales, & Cole, 2019; Slavich & Cole, 2013; Tawakol et al., 2019; Yang et al., 2017). There is ample evidence that stress affects health directly (Segerstrom & O'Connor, 2012; Thoits, 2010). The literature on the subject of stress and health is wide and growing further to expand into different subdisciplines in social sciences. The last several decades were fruitful in terms of acquiring new data that changed our understanding of the stress process and allowed to formulate the mechanisms by which psychosocial stress affects health. Integrating these new findings from medicine, genetics and biology into sociological, anthropological and epidemiological research on stress also brought considerable changes in our conceptualization of stress and the role of social factors in patterns of health, disease, aging and mortality (Bautista et al., 2019; Berkman et al., 2014; Christensen et al., 2019; Kessler, 1983; Lundberg, 2020; McEwen & Stellar, 1993; Pearlin, 1989; Rubenstein et al., 2019; Thoits, 2010; Zannas, 2019). General findings unequivocally point to the modifications in various physiological systems caused by stress experienced by an individual in the early years. The impact of childhood adversity (scarce resources, parental neglect, abuse, etc.) has been shown to produce a cascade of negative symptoms in health in later life (Epel et al., 2018; Fogelman & Canli, 2019; Slavich, 2016; Zannas, 2019). We also know more about social factors that buffer the onset of biological risks (Epel et al., 2018; Fitzgerald et al., 2021; McEwan, 2019; Schattuck, 2021). One of the important acquisitions in the

present-day scholarship on the interaction between the social and biological factors is connected to the introduction of the evolutionary perspective. The research focusing on stress and adaptation has welcomed a few changes accordingly. Specifically, the contemporary stress literature highlights the perspective on the organism's plasticity and the adaptive nature of stress response (McEwan, 2019).

Life history orientation

Although it has been systematically shown that stress affects health outcomes both directly and indirectly, not all stressors have the same capacity to damage health and increase risks of a disease. What is important for researchers of stress and health is to be able to (1) isolate those kinds of stressors that have harmful potential, (2) explain the mechanisms by which stressors can undermine health and (3) explore the buffering factors that stave off the negative effects of stress on human health.

One useful approach that links together social behavior, life stress and health is subsumed under the life history orientation framework. Life history orientation approach provides an account of how a species manages a series of major trade-offs (for example, between quantity and quality of offspring, between early and delayed reproduction, etc.) (Del Giudice, Gangestad, & Kaplan, 2015 for review). The original conceptualization of life history approach, as well as its major categories is derived from evolutionary biology. Life history is conceptualized by evolutionary biologists as a sequence of reproductive events and their timing from birth to death of an organism. Life histories are typically understood to exist on a continuum from "fast" to "slow" (Mishra, Templeton, & Meadows, 2017, p. 242). By emphasizing the speed of going through major reproductive events this approach considers the trade-offs in timing of mating and reproduction, on the one hand, and between parenting effort and parental investment, on the other.

Organisms that exhibit slow life histories tend to display a cluster of features such as slower development, lower fertility, greater parental investment, longer life expectancy, and larger body size, while fast life histories show a reversed pattern (Figueredo et al., 2005). Organisms with fast life histories exhibit behavioral strategies that focus on present-oriented outcomes (showing patterns of impulsivity, devaluing or discounting the future, resorting to strategies such as aggression and/or exploitation rather than cooperation to achieve the desired result, etc.), while organisms with slow life histories have behavioral strategies that focus on future-oriented outcomes, including cultivating long-lasting relationships and social ties, investing in the future, accepting delayed gratification, etc. (Copping, Campbell, & Muncer, 2014; Crysel, Crosier, &Webster, 2013; Daly & Wilson, 2005; Ellis et al., 2012; Mishra & Lalumière, 2008; Mishra, Hing, & Lalumière, 2015). Across other mammalian species humans exhibit relatively slow life histories (Mishra, Templeton, & Meadows, 2017, p. 242). Although initially it was developed to account for inter-special differences, life-history orientation can lend itself to explanation of interpersonal differences within a species as well (Mason, 2020). It is in that aspect that this framework is used by anthropologists and social epidemiologists. For example, low socioeconomic status has been shown to "speed up" the life history orientation as a strategy sacrificing the parental effort while favoring early reproduction under the pressure of life circumstances, while high socioeconomic status has been associated with postponing reproduction as well as tending to long-lasting social bonds, greater cooperativeness and higher parental investment.

Life history orientation in humans has also been the subject of growing interdisciplinary attention, because it provides a wide explanatory framework for understanding individual differences broadly construed (Del Giudice, Gangestad, & Kaplan, 2015; Mishra, Templeton, & Meadows, 2017). Based on the mounting evidence connecting fast life history-relevant traits and circumstances (e.g., age, gender, socioeconomic status, aversive personality traits (the Dark Triad), etc.) with risk-taking, unhealthy lifestyle and alcohol abuse, opportunistic, manipulative, abusive or exploitative behavior, etc., these features have profound implications for studying health disparities on both individual and population (epidemiological) levels (e.g., Crysel, Crosier, & Webster, 2013; Eibach & Mock, 2011; Hill & Chow, 2002; Hill et al., 1997; Mason, 2020; Mishra, Barclay, & Lalumière, 2014; Wang, Kruger, & Wilke, 2009; Wilson & Daly, 1997). More specifically, a greater expression of the aversive psychological traits (the Dark Triad) in adults was traced to adverse experiences (including low socioeconomic status) in childhood suggesting that developing exploitative, impulsive, aggressive or opportunistic behavioral characteristics can be viewed as an adaptation (or even a survival strategy) to early years adversity. Merging the evidence from the domains of social behavior and individual differences will allow deepening our understanding of how these processes interact at different stages of human life and with different socialization experiences.

Social Safety Theory

The effects of life stress on health and wellness are well studied and there is a large empirical literature on the consequences of various dimensions of adversity on patterns of human health, disease, aging and mortality. However, as already mentioned, not all stressors are the same in the way of their potential to affect health. The issue of differential effects of social stressors on health is attended within the frame of Social Safety Theory. Social Safety Theory (Slavich, 2020, 2022) makes an attempt to generalize from the empirical findings connecting social threats to the biological processes underlying the stress response and the physiological systems it regulates. Similarly to the case of life history orientation, this framework seeks to meta-analyze the information from specialized domains of social science and biological knowledge to explain complex higher-level phenomena relevant to health outcomes. Central to the Social Safety Theory formulation is the fact that the "human brain and immune system are principally designed to keep the body biologically safe", which is achieved by the organism's engagement in monitoring and responding to social, physical, and microbial threats (Slavich, 2020). Situations fraught with risks of social losses and dissolutions of social ties (e.g., conflict, isolation, rejection, etc.) also promote likelihood of physical injury and microbial infection, because anticipatory neural–immune reactivity to social threat was likely highly conserved (Slavich, 2020), as in case with the low social standing that increases the likelihood of experiencing a physical attack or pathogen exposure (Cole, 2013, 2014; Murray, Haselton, Fales, & Cole, 2019; Thames, Irwin, Breen, & Cole, 2019). What it implies is that all impactful stressors share the component of perceived threat to organisms' safety, in which the social and biological signals are intertwined. Signals of impending social threats launch the stress response. Systematic or chronic activation of the stress response mechanism leads to dysregulation of the inflammatory processes, increases the likelihood of development of chronic conditions, worsens response to treatment and vaccines (Chen, Miller, Kobor, & Cole, 2010; Cole, 2014; Knight et al., 2019) and leads to the fatigue and ultimately exhaustion of an organism (Cohen, Janicki-Deverts, & Miller, 2007; Kiecolt-Glaser et al., 2020; Lasselin et al., 2020; McEwen & Akil, 2020; Slavich & Irwin, 2014; Turner et al., 2020). Under those circumstances, this evolved multilevel biological threat response can increase individuals' risk for viral infections[8] and several inflammation-related disease conditions (including depressive disorder and heart pathology) that dominate present-day morbidity and mortality profiles (Mackenbach, 2020; Slavich, 2020).

Furthermore, Social Safety Theory (Slavich, 2020, 2022) uses the premise of human sensitivity to social information as a ground to develop an evolutionary-based perspective on the conceptual juncture between life stress, disease and social behavior in humans. This approach builds on the idea that "developing and maintaining friendly social bonds is a fundamental organizing principle of human behavior" to show that "a critical feature of psychological stressors that increase risk for disease are threats to social safety" (Slavich, 2020, 2022). Viewing positive and negative social experiences through this lens affords a biologically based evolutionary account for why certain stressors are particularly impactful (Slavich, 2022).

Social Safety Theory is constructed on three premises that link the state of social safety vs. social stress to positive or negative health outcomes. First, this approach makes a note of the functional advantages that humans gain by means of prosociality and fostering social safety (Fiske, Cuddy, & Glick, 2007; Sober & Wilson, 1998; Tomasello, 2014). Secondly, it is proposed that having social safety has salutary effects and is generally beneficial for health, longevity and well-being. The empirical results indicate that better socially integrated individuals are more productive, take sick leave less often, and tend to demonstrate higher professional and scholastic achievement while living longer years and showing less expressed inflammation in their biomarkers (Slavich, 2020, p. 277). Thirdly, by logically extending the second proposition, it is maintained that damaging or threatening to damage social safety would have negative health outcomes via increased inflammation (Slavich, 2022). For example, experiencing (physical and verbal) aggression, loss or rejection has been shown to promote depressive symptoms and suicidal ideations, as well as increased up-regulation of signaling pathways of pro-inflammatory activity, decreased down-regulation of signaling pathways that reduce inflammatory activity and accelerated biological aging as measured by telomere length (Slavich, 2020, p. 277). While leaving many questions for future exploration, the Social Safety Theory calls for interdisciplinary multi-level research on the life stress to generate

[8] As stress and threats of an attack repress the viral defenses in favor of bacterial defenses. This aspect is particularly important considering the current epidemiological situation and the COVID-19 pandemic.

informative conclusions regarding its biological, clinical and behavioral outcomes.

Conclusions

The last few decades of biomedical research and sociobiological scholarship have cast into sharp relief the role that social ecology plays in health and social behavior. For example, there is empirical evidence supporting the important claims that social factors affect human physiology and can be systematically reflected in such parameters as birth weight, inflammatory processes, obesity, cardiac pathology and mental health in human societies, causing health disparities across different social groups. The mechanisms by which these consequences come about are less well understood, and there is no consensus as to what types of stressors are the most impactful and harmful for human health sufficient to explain the dynamics of health disparities and the cross-cultural variation in social gradient in health (Lea et al., 2021; Mackenbach, 2020; Slavich, 2020). The important emphasis made by the theoretical frameworks reviewed here is placed on linking the cognitive (evaluative) dimensions of stress to their material consequences in health outcomes (including physiological changes), as well as on attracting attention to the importance of investigating the dynamics and principal drivers of the effects of stress in childhood and during the life course, involving the evolutionary explanation.

In socially living animals, distribution of health and illness can be viewed as social phenomena (Schattuck, 2021). As discussed, humans have evolved a greater sensitivity to social disruptions and threats than to changes in physical environments (Slavich, 2020). Furthermore, not only can social relationships modulate the resources available to the organism to launch an immune response but they themselves can influence immune function (e.g., Cohen et al., 1997; Pressman et al., 2005; Schattuck, 2021). Evolutionary approach to health and illness continues to generate valuable theoretical explanations that highlight the important aspects of our species' adaptation (Andrews, 2020; Andrews, Maslej, Thomson, & Hollon, 2020; Nesse, 2000; Slavich, 2022). It offers innovative theoretical tools to the empirical literatures that explore the effects of stress on health and opens new possibilities for theoretical synthesis for the biomedical research on stress and health. Understanding the role of culture as a chronic stressor and the evolved features such as sociality in patterns of disease, aging and mortality can provide fundamental insights into human health and help develop more effective interventions to improve health and quality of life in modern societies.

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ЗВ'ЯЗКИ МІЖ СОЦІАЛЬНИМ СТРЕСОМ, ЗДОРОВ'ЯМ ТА СОЦІАЛЬНОЮ ПОВЕДІНКОЮ ЧЕРЕЗ ПРИЗМУ ЕВОЛЮЦІЙНОГО ПІДХОДУ

Дослідження надають систематичні докази впливу стресу на здоров'я. Існування в соціальній групі створює додаткові джерела стресу, і соціальні стресори є особливим видом стресорів. Людина проводить своє життя в межах групи, включеною у свою соціальну мережу, і організація цього життя характеризується регулярною соціальною взаємодією, складною культурною рутиною та ментальним життям, укоріненим у спроможності інтерсуб'єктивного взаєморозуміння, здатності до навчання в інших та наявності афіліативних потреб. Теорія соціальної захищеності та підхід орієнтації життєвої історії використовують це підґрунтя для розроблення базованого на еволюційно-спрямованій аргументації підходу до життєвого стресу та здоров'я. Підхід орієнтації життєвої історії вже посів належне місце в медичній антропології, соціальній епідеміології та соціології, тоді як теорія соціальної захищеності є інноваційним підходом, побудованим на аналізі психологічної здатності формувати сталі соціальні стосунки, закладеної в соціальності людини. Цей підхід припускає, що загроза соціальній захищеності є критичною характеристикою стресорів, які підвищують ризики розвитку захворювань. Таким чином формується ланка між соціальною поведінкою, психосоціальним стресом та здоров'ям людини, якщо розглядати цей концептуальний вузол через призму еволюційного підходу. Своєю чергою, підхід орієнтації життєвої історії ґрунтується на теоретичних засадах еволюційної біології та поширює еволюційно-біологічні закономірності у сферу формування психологічних процесів і наслідків для здоров'я. Одним із внесків цього підходу є його сполучення з поясненнями соціологічних рамок, які поєднують ефекти несприятливих життєвих обставин у дитячі роки з наслідками у здоров'ї та соціальній поведінці в дорослості. Обидві ці рамки пропонують важливі концептуальні вузли для дослідників стресу, здоров'я та соціальної поведінки, оскільки вони пояснюють канали, через які соціальна екологія може впливати на біологічні ризики.

Ключові слова: групова належність, еволюція, стрес, запалення, здоров'я, захворювання, еволюційна невідповідність, теорія соціальної безпеки, орієнтація життєвої історії.

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