

THEORIES ON STRESS

TEORIE SULLO STRESS

COLLECTED PAPERS OF THE INTERDISCIPLINARY RESEARCH PROGRAM "ORGANIZATION AND WELL-BEING"

EDITED BY GIOVANNI RULLI

Abstract

Two theories on stress are introduced. The first one proposes the unification of the two great research traditions on stress, biological and psychological, within a systemic science, psychoneuroendocrineimmunologic, aimed at both explaining the complex interaction between different levels of stress incidence on health and disease, and integrating the care of the others and the care of oneself. The other theory, oriented towards the study and the improvement of human being's condition, especially well-being at work, criticizes the psychological interpretative perspectives. According to this theory, stress is conceived as a psychoneuroendocrineimmune process, while health and prevention are seen as perfectible processes. Several differences, compatible elements as well as synergies between the two theories emerge.

Keywords

Stress, Well-being, Psychoneuroendocrineimmunology, Prevention as process, Organizational action.

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Introduction

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Theories on stress - Introduction

On January, the 20th 2014, the 44th Seminar of the Interdisciplinary Research Program on the relationships between organized work and health “Organization and Well-being”: *Well-being, Prevention, Stress* has been held at the University of Bologna. The two perspectives proposed by the “Organization and Well-Being” Program and by the Italian Society of Psycho Neuro Endocrine Immunology were compared.

The O&W Program concerns the connections among the choices, operated and designable, about work processes and the well-being of the people involved. Its activities on this object of study include analysis of work situations, ergonomic design, education and training. The different disciplinary knowledge requested, biomedical, social, economic, psychological and polytechnic, are integrated within the utilization of the Method of the Organizational Congruences.

The Italian Society of Psycho Neuro Endocrine Immunology, a multi professional and multi disciplinary association, considers - as the Statute indicates - human reality in relation to its complexity, health and illness in their biopsychosocial dimensions, it promotes the development of integrated interventions and policies, based on the equal dignity of the sciences and the professions, on the recognition of the different and specific professional competences and on a shared patrimony of common knowledge.

The Seminar offered an opportunity to compare two perspectives of study and research, directed to the promotion of *well-being*, that encourage to consider the complexity of human action and human beings. The focus of the comparison has mainly been the *stress* because of its centrality within a long-lasting debate that involves human beings not only in their relationships with

the work but also with respect to every other moment of life.

This collection of papers introduces two main contributions to the Seminar, by Francesco Bottaccioli and Giovanni Rulli, recalling the epistemological, theoretical and methodological references of the two perspectives, with a particular focus on *stress*, allowing the reader to appreciate the different points of view and, at the same time, the synergic aspects, from the world view implied to the understanding and the change of reality, with the goal of prevention and well-being.

In the *Stress science as a whole organism science*, Bottaccioli criticizes the “reductionist and mechanist” illusion of a certain biomedical approach which has the tendency to simplify and to reduce to linear “incontrovertible” connections the complexity of life. Through the story of psycho neuro physiological research lasting almost one century, starting from the first studies that lead Hans Selye to his first important publication in 1936, Bottaccioli reconstructs the basis on which the Psychoneuroendocrineimmunology is founded, defining this approach as a “model of research and interpretation of health and illness that sees the human organism as a structured and interconnected unity, where the psychic and biological systems are reciprocally conditioned”. He defines the science of stress as systemic science, in the sense that integrates biology and human physiology with the modulation represented by the psyche. This last, produced by the biological organization, but contemporarily source of its conditioning, is integral and founding part of the body and it can modify the morphology of the brain through the mental activity. It is not therefore neither superficial “physical process” neither “immaterial spirit”. The Author concludes wishing the unification of the great traditions of study on stress, biological and psychological, in the psychoneuroendocrineimmunological perspective, considered as a systemic science, so that “to rigorously explain in scientific terms the complex interaction among the different levels that determine human health and illness”, and to integrate the care of the others and the care of itself.

In the text *Well-being, prevention and stress as processes*, Rulli first introduces the consolidated definitions of prevention, well-being and health, more and more oriented to consider the latter as mean for human flourishing and not as a goal. Nevertheless he points out that in this pathway the interventions of prevention were separated and broken up, especially the primary prevention, which is not only of biomedical competence and it is oriented to prevent the emerging of risk, not its reduction or, worse, its “management”. He then recalls Hans Selye’s studies, founder of the psychoneuroendocrine approach to stress, inviting neither to consider the “cognitive evaluation” as the only explanation of the “stressful” relationship between individual and environment, nor to reduce to the intervention of a “first mediator” the activation of the articulated and complex development of stress. Also, he focuses on the condition of the human being at work, and he defines health and prevention as *perfectible processes*. He finally criticizes the current approaches to the prevention of stress – such as the 2004 European Agreement - supporting an improper responsabilization and psychological empowerment of workers. Rulli defines stress as *psychoneuroendocrineimmunitary process*, and he also emphasizes the possibility to realize a truly primary prevention even of the negative effects of stress through a research of the *organizational etiopathogenesis* of risk, within an analysis of work oriented to the pursuit of a better congruence among its components, not separable from the acting subjects and therefore from their well-being.

The two texts will allow the reader to recognize differences, synergies and common perspectives of the two research programs. Some aspects are particularly worth comparing.

There are certainly some differences among the two approaches, for instance with respect to the privileged use of the terms *paradigm* and *model* in the SIPNEI perspective, while the O&W Program perspective sets the accent on *theory* and *method*; or still, regarding stress, the SIPNEI perspective chooses to

use the concept of *system*, while the O&W Program perspective insists on the concept of *process*.

Nevertheless there are very important common points in relation to the problems set by the objective of well-being. Both approaches avoid the simplifications that reduce reality, events and complex organisms, to linear correlations, cause-effect relationships, action-reaction, stimulus-response, and both approaches recognize the deep connections between body and psyche and between human beings and environment. Both put emphasis on the idea that well-being should be pursued through self care, which means in one case to have particular attention to the promotion of our own psychophysical well-being and of new relationships of care, in the other case to have the capacity to describe and to interpret what, for instance at work, can be consciously modified, as a collective choice within a perspective of primary prevention of discomfort and suffering. Despite a misleading interpretation of reality takes for granted that technical progress is associated to social progress, and therefore there is an historical, unavoidable orientation towards well-being, in the workplace certain logics that are contradictory with well-being promotion still remain in place, are reproduced and sometimes prevail.

Thus, it appears desirable to grasp the possible synergy between these two perspectives, particularly in work processes, by claiming the need for better awareness and interventions by involved subjects, by promoting their ability to interpret their own work reality in order to identify the existing or possible conditions of risk and to participate to the care of themselves. At the same time, these pathways allow to propose and to operate organizational choices that are congruent with the objective of well-being.

Stress science as a whole organism science

Francesco Bottaccioli, Founder of SIPNEI, Università dell'Aquila

The end of the illusion of reductionism

We are living the end of a great illusion lasted more than four hundred years: the illusion of being able to reduce to simple determinants and, thus, to incontrovertible knowledge the complexity of life, in sickness and in health (Bottaccioli, 2014a; Rose, Rose, 2013). Illusion that founded the mechanistic and reductionist biomedical paradigm, nourished from the “mechanical philosophy” brought forward, since the seventeenth century, by a vast movement of philosophers, physicists and physicians (Bottaccioli, 2014b)

The dominant paradigm no longer seems capable of producing significant advances in the knowledge and practice of care (Fani Marvasti, Stafford, 2012). The paradigm of Psiconeuroendocrinoimmunology looks like as the answer to this crisis. Psychoneuroendocrinoimmunology is the discipline studying the bidirectional relationships between the psyche and biological systems (Bottaccioli, 2005; Ader, 2007; Kusnecov, Anisman, 2014). After 1930, the knowledge acquired by endocrinology, immunology and the neurosciences converged into a single model: psychoneuroendocrinoimmunology.

Hans Selye (1936) demonstrated that stress response is independent from the nature of the stimulus. Following studies reinforced this concept proving that stress can be activated by physical, infectious and psychological factors. Independently from the kind of stressor, a neuroendocrine and neurovegetative response is then activated with the subsequent release of hormones and neurotransmitters from the adrenal glands. In the mid-1970's, the German physiologist Hugo Besedovsky (1983) proved the immunosuppressive effect caused by an increase of cortisol produced by the adrenal glands during a stress response. The first biological connection between the brain, stress and the

immune system had been established. In the second half of the 1980's, the American physiologist Edween Blalock (1989) showed how lymphocytes have receptors for the hormones and neurotransmitters produced by the brain, and at the same time they produce hormones and neurotransmitters that are similar to the cerebral ones. The bidirectional communication between the brain and the immune system was hence proved.

More recently it has been proved that peripheral nerve fibres innervating the entire body release substances (neuropeptides) that activate or suppress the immune response, thus explaining for the first time the possibility that an inflammation can have a nervous origin (neurogenic inflammation). At the same time, it is now clear how cytokines, which are released by the immune cells, pass through the blood or the large cranial nerves (such as the vague nerve) and are thus able to carry signals to the brain hence influencing both biological (fever, hunger, satiety etc.) and psychological activities (anxiety and depression).

During the 1990's there was a significant increase in studies on the neurobiology of emotions. Emotions, traumas and in general stressful events cause a dysregulation in the stress system which strongly alters the disposition and the functioning of the immune system. In the short-term cortisol, adrenaline and noradrenaline (catecholamines) have a tonifying effect also on the immune system. In the mid to long-term, these substances place the immune response in an unsuitable position to fight viruses and tumours. Similarly, the dysregulation of the stress axis can favour the onset of different types of autoimmune diseases (Del Rey, Besedovsky, 2014).

By the end of the Twentieth Century, the works of the American neuroscientist Robert Sapolsky and other scholars have proved that the alteration of the stress system and an overproduction of cortisol can result in the atrophy of the hippocampus, the cerebral area responsible for long-term memory formation. Studies of the first decade of the Twenty-first Century show that even diseases such as atherosclerosis and heart disease are usually strongly affected by the subject's mood. Depression, with the overproduction of cortisol

and catecholamines, contributes to alter the inner wall of the vessels, favoring the formation atherosclerotic lesion and worsening the prognosis of people who have suffered of myocardial infarction (Lichtman *et al.*, 2014). Thus, the occurrence of some myocardial infarction or other acute cardiac failures, tied to mood disorders, can be explained by the presence of vascular alterations caused by an imbalance in serotonin levels (Carnevali *et al.*, 2012; Steptoe, Brydon, 2009). To conclude, in the first decade of this century, research conducted mainly by the Belgian psychiatrist Michael Maes and the French neurobiologist Robert Dantzer proved that an immune inflammatory dysregulation can be responsible for symptoms which are normally referred to as “somatization disorders” as well as “psychosomatic symptoms”. All of these symptoms are tied to disorders that fall either under the care of psychology and psychiatry (anxiety, depression, chronic fatigue syndrome) or disorders belonging more specifically to the medical field (autoimmune diseases, cancer); for a recent review see Irwin, and Rothermundt (2012).

With Psychoneuroendocrinology (PNEI) a model for research and for interpreting health and disease has arisen. It considers the human body as a structure and as an interconnected entity where the psychological and biological systems influence each other reciprocally. This provides the basis on which to outline new integrated approaches to prevention and therapy of the most common diseases, especially chronic ones. At the same time it provides the possibility to go beyond the old philosophical dichotomy between mind and body as well as the scientific dichotomy between medicine and psychology, by overcoming the respective reductionism which assigned the body to the care of medicine and the psyche to the latter.

The science of stress as a science dealing with the organism as a whole

PNEI research was developed from the experimental pathology research carried out by Hungarian scientist Hans Selye, who is rightly considered the father of stress research.

From the 1930's until his death in 1982, Hans Selye focused his research on the adaptation of human and animal organisms in response to different kind of stressors (physical, psychological and toxic agents). Hence the object of Selye's study was the living organism as a whole. This approach to the unity of the organism was based on the experimental observation that the axis of stress in animals was activated independently from the nature of the stressor. The adrenal axis of an experimental mouse could be activated by a virus, a bath in icy water or catching sight of a predator.

This conclusion clashed with the results that were emerging from American cognitive psychology thanks to the work of Richard Lazarus (1999). During the 1960's, this branch of psychology was fully engaged in investigating the area of stress with an extensive series of experiments and observational studies focusing on the adaptation modalities of the human being when faced with stressful events. Lazarus' criticism of Selye's approach divided the field of stress research into two still existing mainstreams: the psychological and the biological.

Lazarus' central concepts were that physiological and psychological stressors cannot be superimposed for different reasons. Particularly, psychological stressors need to be mediated by the mind, unlike the physiological stressors. Referring to Mason's studies on monkeys, Lazarus highlights that the physiological stressors have a minor impact on the stress axis compared to the psychological ones. Therefore, Lazarus says, the systems activated by them are also different. Lastly "Selye does not help us to understand the way psychological stressors work; he only says how they affect the body" (Lazarus, 1999: 48).

In order to analyze Lazarus's objections, it is necessary to recall Selye's concepts about this point: "It may be difficult to see at first how such essentially different things as cold, heat, drugs, hormones, sorrow and joy could provoke identical biochemical reactions in the body. Nevertheless this appears to be the case. It can be demonstrated scientifically by highly objective quantitative biomedical and morphological parameters that certain reactions to stress are

totally nonspecific, and common to all types of stressors, whatever their superimposed specific effects may be" (Selye, 1976a : 14).

Hence it is not true that different stimuli have the same effects; this would be ridiculous (a tachycardia caused by erotic stress has very different effects from a tachycardia caused by viral stress!). However it is true that they produce the same basic reaction: they activate the stress system both at central and cellular level. This is now well documented. When bacteria or a virus get into the body, our immune system releases cytokines that reach the brain and activate the stress system. The same stress system can also be activated by an emotion. It is less known that this stimulus "non-specificity" is present even at cellular level. Indeed an immune cell can be activated by viral and bacterial products, inflammatory cytokines, oxidative derivatives in food, or by stress: the cell actually has receptors for epinephrine and norepinephrine, which are the neurotransmitters of the stress response.

Hence, even if it appears wrong to consider a basic difference between psychological and biological stressors, there is undoubtedly a peculiarity to the psychological stressors: it appears the most important element in Lazarus' thought. This peculiarity emerges clearly in placebo trials. There are very interesting clinical trials on this issue that have used the so called "open-hidden paradigm", where the same patient receives the same treatment, i.e. an analgesic drug either in a standard open manner, therefore with full awareness of it, or in a hidden way, being therefore unaware of it. If a patient to whom an infusion is being administered does not know when he/she will receive the analgesic drug, 50% more of the normal dosage will then be necessary to obtain the same effect as when the drug is expected (Benedetti, 2011: 208).

It is therefore obvious that, for better or worse, the psyche is a powerful modulator in biology. This ambivalence was already very clear from the Selye works about stress as a adaptive system: "We must not suppress stress in all its form, but diminish distress and facilitate eustress [...] Stress is the salt of life [...] Total elimination of stress would be equivalent to death" (Selye, 1976b: 56). Here is the fundamental question: how does the psyche work? What are the

mechanisms according to which an internal or external event triggers an activation of the stress system? This is certainly the main question asked by Lazarus, and a subject where psychological sciences make a decisive contribution to all research into stress in human beings. It is a question that is impossible to ignore. If a study on stress is limited to an examination of the relationship between the mediators of the main biological systems (neurotransmitters, cytokines, hormones), this means that it studies an artefact, not the human organism under stress.

The psyche as a product and condition of the life of the organism

The psyche is an integrating part of the meta-system. It is the product of the biological organization and, at the same time, is a fundamental source of conditioning of the biological organization itself. It is necessary to fully understand that the biological and psychological levels are inextricably entwined. If we miss this point, we will face a divergence resulting in two streams of thought: biologism and subjective idealism; in other words, a stream that considers the psyche nothing more than a synonym for the brain and, on the other hand, a stream that recycles the old metaphysical concept of Soul or Spirit. In the uncertain terrain of subjectivism there is a convergence of single ultramechanistic approaches such as the one proposed by the British mathematician Penrose (his theory reduces consciousness to “a basic physical process represented by microtubules”, [Penrose 1997: chap. 3], which are microscopic cellular structures whose function includes the transport of molecules) and approaches that are straightforwardly idealistic and based on a concept of the Soul or Spirit as an immaterial tertium between psyche and body.

As a matter of fact, the psyche is an integrating and constitutional part of the body. Donald Winnicott, a great scholar and clinician of the psyche, especially in children, described it as an imaginative representation of the bodily functions: “The body is essential to the psyche, which depends on cerebral functioning and is generated as an imaginative organization of the

body functions” (Winnicott, 1988: 123). This psyche-body system then develops a function: the mind.

In a recent review, Arne May, a neuroscientist from Hamburg, lists the identified correlations between behaviours and brain plasticity (see Table 1) and subsequently recalls humorously the famous conundrum of “what came first, the chicken or the egg?” (May, 2011).

Table 1: Correlation between behaviours and brain plasticity (May, 2011).

<i>Behaviour</i>	<i>Modified areas and cerebral circuits</i>
navigation	hippocampus
music	motor and auditory areas
basket	cerebellum
dancers	motor system
golf	frontoparietal network
mathematicians	bilateral inferior parietal lobes
Baduk players (Chinese board game)	total grey matter

Along with these correlations between brain structure and behaviours, a series of experiments has also speculated about the molecular paths that turn behaviours into a new cerebral asset, showing the increase in signals that are essential to the activation and growth of nerves as BDNF, NGF, NMDA. Prospective parallel studies have been carried out in order to remove any doubt. In these studies researchers followed people who were learning new skills and cognitions over a period of time.

The first of these experiments recruited university students who were then asked to learn the “basic juggling pattern”: throwing three balls in the air and managing to keep them moving without dropping them. The students’ brains were scanned before the beginning of the juggling training, then after three months when they had learned the technique, and then again three months after they had stopped exercising. After three months of training, the

middle temporal areas related to motion show an increase which recedes three months after the end of the training.

The second experiment involved German medical students. At the end of the third academic year, students are required to pass the very demanding state medical examination, the so called *Physicum*, a summary of all the main matters studied in the previous years. This hard examination requires an average period of two-month of intense study. In this case too, the participants' brains were imaged before studying and then after two and three months. Neuroimages show significant growth and an increase of grey matter in two crucial learning areas: the posterior parietal cortex and the hippocampus. Of particular relevance is the fact that after three months the hippocampus, especially the right part, continues to grow as if it were elaborating the acquired information further (Draganski *et al.*, 2006).

The conclusion could be that mental activity modifies brain morphology regardless of whether it involves acquisition of abstract notions or acquisition of motor skills. We can therefore say that the software running on the brain machine modifies the machine itself. This is the reason why the psyche-brain system cannot be compared to the computer-program system. In this latter case hardware does not change by changing the software, whereas in the first case the software modifies the hardware. This is also why the study of psyche and brain cannot involve a separation of one from the other. Being aware of the psyche-brain system as an inseparable unit permits the definition of a unitary science of stress able to look ahead without a distorted perspective either on the psychological side or on the biological one.

PNEI, the science of stress and the biopsychosocial model

From the arguments and scientific data reported thus far, it can be deduced that it is now possible to unify the two great traditions (biological and psychological) of stress research with the aim of reconstructing the health/disease balance and mechanisms that concern the individual seen in his/her entirety. What is needed is a new science of stress, which will emerge

from the narrowness of the Twentieth Century scientific culture, with its roots in the reciprocal reductionism that has dominated psychology and biomedicine (Bottaccioli, 2011).

Scholars of psychological sciences answer to this question by arguing that for some time there has been a systemic approach called the “biopsychosocial model”. This proposal was published nearly forty years ago in *Science* (Engel, 1977) when the author of the article, George Engel, indeed presented a very effective criticism of the dominant biomedical model by identifying its pillars: reducing complex phenomena to simple determinants (reductionism), separating the biological phenomena from the psychosocial ones (mind-body dichotomy), and interpreting vital phenomena in physical-chemical terms (physicalism). Unfortunately the course of history has not quite matched the vision set out by the American gastroenterologist trained in psychosomatics. The biopsychosocial model has indeed become an ideal reference point for those new branches of psychology whose field of research focuses on health rather than psychological disorders. The crisis of the biomedical model has not decreased since 1977, indeed it has worsened, beginning with its traditional weak point: psychiatry. This is why voices recently opposing a possible revival of Engel’s proposal came precisely from the area of psychiatry. The biopsychosocial model is accused of being too generic, not explaining with which mechanisms the different levels interact to cause any resulting disorder, thus creating a situation of “paralysis by complexity” for researchers and therapists (Ghaemi, 2010).

Indeed, over the last few decades the biopsychosocial model has preserved the idea that another vision of medicine and psychology is possible, but in all honesty it has not given direction to research that could explain the mechanisms that link up the biological, the psychological and the social interdependently. Thanks to Psychoneuroendocrinology we have now all the tools and a rich and growing body of documentation that explains, in strictly scientific terms, the complex interaction between the different levels that determine human health and disease. It is therefore no coincidence that

distinguished researchers in psychological sciences, such as Shelley Taylor and Janice Kiecolt-Glaser, see Psychoneuroendocrinology as the way forward for psychology. In an editorial published on *Perspectives in Psychological Science*, Kiecolt-Glaser writes that “Psychoneuroimmunology is psychology’s gateway to the biomedical future”. It is indeed the dominant contribution, she writes, that psychology can make to changing the biomedical model and practice. In order to achieve this goal, it is necessary to have an interdisciplinary framework for health operators and researchers (Kiecolt-Glaser, 2009). In short, the convergence of biomedical and psychological sciences into the Psychoneuroendocrinology paradigm could lead to a historic breakthrough in the concept of the human being and healthcare (Segerstrom, 2012: Preface).

In conclusion, what is needed, therefore, is a science of whole organism (Bottaccioli, 2014a) and a care that is based on precisely that, which focuses on increasing the self-adaptive capabilities of the subject, namely its ability to take care of himself. This involves important changes in the scientific structure and in healthcare professions; a change to be made especially in the finalities and modalities of caring for the other. It must be based on the care of oneself, also through meditative techniques and techniques of stress management, characterized by documented efficacy (Bottaccioli *et al.*, 2014). The therapist-patient relationship is not two-way, but, as noted Hippocrates, to be effective, must be three-way: the patient, the doctor, the art. The aim of this relationship is to allow the patient to have access to the art (healthcare sciences) through the technician (Bottaccioli, 2010). The person who asks for help is at the centre of this relationship, which will be the more effective the more it leads to an increase in awareness in both people: the one asking for help and the one providing it.

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Well-being, prevention and stress as processes

Giovanni Rulli, ASL della Provincia di Varese, Università dell'Insubria

Well-being and health

The term “well-being” has been used over time with different meanings, from the simplest “absence of illness”, and *validity* (to the maintenance through the job, to the procreation, up to the war), to the most general and complex, promoted and diffused during the second half of the last century by World Health Organization that defined *health*, in its 1946 constitutive act, as “state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO, 1946 -1948).

Subsequently, at first on the occasion of the International Conference on the Primary Cares of Alma Ata (Declaration of Alma Ata, 1978), then in the 1986 Ottawa Paper (WHO, 1986), the concepts of health as *fundamental human right* and *promotion* of health as “process of enabling people to increase control over, and to improve, their health”, have respectively been introduced. Therefore, health is not a simple resource for daily life but a *means* to give value to the most general personal and social resources, among which, but not only, physical abilities. For the promotion of this resource-means, it remains nevertheless broadly unsolved the issue of the relationships, often conflicting, between individual behaviours and choices, on the one hand, and behaviours and collective choices, on the other.

Prevention

Modern prevention was born in the '700: at the end of that century, the first of nine volumes, published in the four different towns, of the essay on the so-called *medical police* of the German physician Johann Peter Frank (1779-1827) was published. He had the ambition to pursue better hygiene and public health

conditions, both through a complete identification of the main social illnesses and their causes, and through the promulgation of laws imposing actions and behaviours in health's defence. The public medicine and the so-called *social medicine* owe a lot to the Enlightened formulation of Frank, who also made reference to the thought of Jean-Jacques Rousseau to found his own reflection.

For various reasons and epidemiological evidences, over time the notions of *primary prevention* (aimed at reducing the incidence of illnesses by intervening on the "factors" of risk, on the "pathogen causes", before that these might generate the manifestations of their own effects) *secondary prevention* (precocious diagnosis, precocious therapy) and *tertiary prevention* (aimed at preventing invalidating results and death) became common. Today, this distinction appears to be too rigid, because, on the one hand, it leads to the segmentation of the possible interventions and, on the other hand, to the creation of "confinements" among the disciplines, first of all biomedical, dealing with prevention (hygiene and prevention, diagnostics and therapy, rehabilitation).

Stress

The term *stress* assumes different meanings according to the disciplinary contexts in which it is used and the objectives pursued by whom deals with it. We believe, nevertheless, that it is first necessary to refer to the original studies of Hans Selye, particularly to the 1256 pages of his most known text, *Stress in health and disease* (Selye, 1976), published 40 years after his first official communication on the matter (Selye, 1936).

With such term, indicating complex and *nonspecific* neuroendocrine activation (a "specific" stress doesn't exist), the aspects of solicitation (*stressor*) are connected with those related to the "stereotyped" response in the *General Adaptation Syndrome*, in which a *reaction of alarm*, a phase of resistance (*adaptation*) and a phase of *exhaustion* are recognized, with correlated biochemical alterations (i.e. hormonal, centered on the release of corticosteroids and catecholamines), morphological (i.e. in the glands) and functional (i.e.

neurological and cardiovascular). Once the capacity of adaptation is depleted, which we can substantially consider to correspond, even if not in a coincident way, with the homeostatic ones from the studies of Walter Bradford Cannon (1932/1963), the organism can manifest the so-called *adaptation illnesses* (that is, from “bad” adaptation to stress) among which, according to the studies of Selye (Selye, 1976), shock, gastrointestinal illnesses (peptic ulcer, colitis, etc.), cardiovascular illnesses (hypertension, etc.), disturbs on hormonal base (diabetes mellitus, etc.), alterations of the immune system (immunosuppression, autoimmune illnesses, etc.), “psychosomatic” illnesses (allergies, asthma, dermatitis, etc.), straight psychosis and, finally, neoplasms.

Therefore, in the term *stress* both causal aspects and the effect emerge. They could manifest independently from the cognitive intervention, as Selye claimed, when he argues that in the human being, because of the peculiar development of his central nervous system, the emotion is one of the most frequent activator of stress, but not the only determinant, since typical reactions from stress can be introduced in subjects exposed to heavy work, traumas, etc., and also under deep anesthesia.

The fact that *psychoneuroendocrine* activation of stress is a very complex event, not serial, it is shown also by the nonspecific neurohormonal manifestations straight after surgical elimination of the hypothalamic afferencies or under general anesthesia. In reference to Selye’s thought, we can speak of *psychoneuroendocrine* definition and not *psychoneuroendocrinoimmune* (certainly a more complete definition today) because it was clear to the Scientist the fundamental participation of the immune system to the phase that we could define *effeferent* of the stress, while its participation to the *afferent* phase has been indeed well identified and clarified only later, as Francesco Bottaccioli reminds us in his fundamental text (Bottaccioli, 1995/2003/2005, particularly in the chapter “Il sistema immunitario”).

A fundamental difference between *psychoneuroendocrine* stress as conceived by Selye and *psychological* stress (Lazarus, 1966) lies in the different answers to the questions: “What is the stimulus that alerts the organism about

the danger or the increase of demands?” and “What is the mediator that, departing from even extremely different stimuli, involves the centers controlling the stereotyped answer of the General Adaptation Syndrome?” In the *psychological* definition, the first passage, independently from the following involvement of substances or neuronal transmissions, is the cognitive *evaluation* (which, by the way, doesn't coincide with a deliberate conscious action), according to the words used by Lazarus. Thus, *stress* is interpreted as a particular “... relationship among individual and environment, which is evaluated by the individual as interaction that tries or exceeds his/her own resources while putting in danger his/her own well-being. The fact that a particular relationship individual - environment is more or less stressful depends on a cognitive evaluation...” (Lazarus, Folkmann, 1984: 21).

In the *psychoneuroendocrine* definition the first passage is coincident instead with the intervention of the so-called *first mediator*, which was thought, and wished, could be a specific substance, initially identified with the histamine, hypothesis then experimentally demonstrated insufficient to explain too many alternatives and exceptions. Today, after three quarters of century of research, it is necessary to speak of a *first mediation* (Rulli, 2011a), that is an articulated fall, possibility, of biochemical and humoral complex events (excess or lack of chemical substances, nervous stimuli, etc.) leading to many well known stereotyped responses (endocrine, neurological, immune), with varying intensity and prevalences of effect on organs and apparatuses. This also happens thanks to the liberation of substances (nervous mediators and/or endocrine ones) and the intervention of *mediating cells* (acting through receptor relationships or thanks to the liberation of other substances, among which the cytokines), as well as thanks to the remarkable role, in the human being particularly, of the psyche. That's why, consequently, we can consider stress as a *psychoneuroendocrineimmunitary process*, to underline its varying development aspects that, even with important characteristics of stereotypy, do not allow in any way to argue a simplified relationship “cause-effect” or “stimulus-response”.

In this paper, it must be said, we do not take in examination and we have not also focused on other fundamental contributions to the *theories* of stress, such as those of John Wayne Mason (1975), with which H. Selye, during the 70's, had an important exchange of ideas in order to clarify the importance of the distinction between *stressor* and *stress*; or Tom Cox (1978), whose contribution has underlined the element of *perception* of the unbalance between requests and resources in the genesis of the stress; or Robert A. Karasek (1979; 1998), who proposed a "model" where great relief is given to the concept of loss of *control*, personal and/or social, on the job itself and on decisions, as the origin of stress; or still, more recently, Bruce S. McEwen (1998; 1999), with his introduction of the *allostatic charge* concept and the most precise identification of the role of *hippocampus*, and its morphological plasticity, in the mechanisms of stress. Such "omission" is voluntary, because the scientific position of Lazarus and Folkmann appears to be the most interesting to discuss, in order to expose the risks of the "psychologist" drifts of the concept of stress.

Well-being, health, prevention and stress at work

Work is one of the fields of action of the *Interdisciplinary Research Program on the relationships between organized work and health "Organization and Well-being"* (O&W) (www.taoprograms.org), as situation of the human action in which well-being is threatened by the daily risk of accidents and professional illnesses, including death. Well-being, prevention and stress can specifically be placed at the center of a perspective specifically oriented towards work, as a process of human action and *passion* covering an extremely relevant lifetime.

What have we to mean with *prevention at work* today? Certainly the prevention of illnesses, of accidents, but also the prevention of discomfort (physical, psychic and social). Unfortunately the prevailing perspectives of analysis and interpretation of work and the majority of the current initiatives of prevention are set too much downstream in comparison to the critical points in the study of the job. Such perspectives, implying a predetermination, mainly *technical*, of the system, do not allow to disclose the different organizational

dimensions of the risk of illness and suffering, and, in the end, they are not only unsatisfactory, but also self-defeating, if a perspective of primary prevention is pursued (Rulli, 2011b).

Recognizing *work as a process of decisions and actions rationally directed toward objectives* (Maggi, 1984/1990) allows to grasp its complexity, and also to pursue the concrete possibility, an interdisciplinary one, without aprioristic ties, to hypothesize and to make alternative choices that are more congruent with the objectives of the work process, including the workers' well-being. Well-being, in this perspective, it is in fact one of the integrated dimensions in the process of work and, as any other, perfectible. By consequence, and in coherence with the principles expressed by the World Health Organization, *health* can be fully defined in terms of *perfectible process of well-being* (Rulli 1996), expression of the intersection between individual and collective aspirations, in evolution with the environment, also work environment, since health is not a natural "state", but a social construction, reported "to the own culture, inserted in the context, in relationship with its geographical places and the different social realities", as Bruno Maggi reminds us (2006a: 62).

When we talk about *primary* prevention, we should refer not only to the action aimed at *avoiding* the encounter between noxious agents and human beings, on the contrary the action *to prevent the realization* of conditions of harmfulness, by refusing the admission of the harmful agent in the work environment. This notion is coherent with the spirit of the European normative framework on the prevention in the workplaces (Council Directive 89/391/EEC, art. 3 and 6), which defines the prevention as *primary, general, programmed and integrated in the conception of work*.

In this sense *prevention* is itself a *perfectible process* (Rulli, 2011c), not an action or an intervention located within a certain time and place (primary, secondary, tertiary) of the pathway that conducts to illness or damage.

Let us talk about *stress in the workplace*. In the European Framework Agreement on work-related stress, signed October the 8th 2004 between the employers' and the workers' organizations, the definition of stress adopted is

the following: “state, which is accompanied by physical, psychological or social complaints or dysfunctions and which results from individuals feeling unable to bridge a gap with the requirements or expectations placed on them.” In this definition, besides the elements of perception, those aspects of personal “control”, as “personal ability” to reduce the possibility of onset of stress also appear relevant. An approach to work that considers stress only what is “assessed” as such, and that it is “checked” from a cognitive point of view, on the one hand doesn’t allow to recognize many possible stressogenic noxious agents (for instance chemical-physical-biological), on the other hand doesn’t even allow to imagine possible *primary* preventive actions, oriented to avoid conditions and stimuli of potential unspecific harmfulness.

The national laws consequent to the 2004 European Agreement, among which the Italian ones of 2008-2009, propose a partial approach, both by identifying a specific evaluation of the risk of stress (as if it had not previously been possible to identify this risk on the basis of the available interdisciplinary knowledge), and by pointing out the ways through which to operate this evaluation, according to the guidelines *ad hoc* produced (as if unitary pathways of job analysis allowing to adequately identify every possible risk didn’t exist). Also, the idea of defining sets of “objective indicators” of stress (Ispesl, 2010; Interregional Technical Coordination for the prevention in the workplace, 2010), to which should follow, only in case of “positiveness”, organizational analysis and workers’ involvement through questionnaires on their “subjectivity” (besides, always of social psychological orientation and not also psychoneurophysiological), is invalidating the possibilities to detect situations of risk and to operate interventions of primary prevention. There are well known indicators to which is attributed absolute “negative” meanings, and not in relation to the specific contexts in which they manifest themselves: two examples are the high turnover, when there are specific cases in which it is not entirely negative but an indicator of emancipation from deleterious activities, and absence from the job, which is typically not applicable to hierarchical positions in which absence is not admissible (in its value of shelter-event). It is

becoming more common to consider that there are strong possibilities of underestimation of the risk of stress, because of too many of *false negative* indicators and, also, a possibility of overestimation because of some misleading *false positive* indicators.

The specific evaluation and the methods of evaluation are also based on the assumption that the risk of stress depends on “organizational factors”, separated from choices concerning environments, materials, techniques, etc. As Maggi reminds us, “The use of expressions as ‘organizational factors’, [...] is a clear indicator of an uncertain and inadequate interpretation of work reality [...] every configuration of work processes is the consequence of choices of human action, choices that organize, in one way or another, such process. The etiopathogenesis of the situations of work is necessarily organizational” (Maggi, 2006b: 15).

Finally, to support and to promote innate or acquirable strategies of coping, that is, of positive cognitive elaboration of the stressors (increase of the threshold of tolerance, promotion of the “resiliency” and of the “psychological fitness”), or to rely on the rising up of “psychological and social” signs and symptoms of stress (besides unspecific), results in a paradoxical, however not explicit, search for “healthy and strong cognitive constitution”, although, at the beginning of the 90’s, after decades of debate in our Country, we succeeded in eliminating the concept, and the relative sanitary certifications, of “healthy and strong physical constitution”. Similarly some orientations of the law and of the disciplines that deal with work can be criticized, when they turn to the “management” of the risks and not to the prevention, or when they propose policies of wellness and promotion of the “satisfactory quality of the life at work”. One of the indicators of the missed achievement of the objectives of primary prevention is the attention shift from the *well-being* (the physical, mental and social health) pointed out by the World Health Organization, toward the *wellness*, which in USA is also defined as “worksite health and wellness”. In Italy as well a lot of enterprises propose policies of wellness, unfortunately alternative to those of prevention, since they see in them the

possibility to attribute to the workers the responsibility to sustain themselves in satisfactory health, by promoting forms of empowerment (for a “greater productivity of healthy employees, with smaller absences and an increased business profit”, to quote a recent sentence of an italo-american business advisor that has taken contact with the Program O&W), thus avoiding their own responsibility, which in Italy is stated by the Constitution, to assure conditions of work that don’t damage the health and the safety, besides conditions of freedom and dignity.

A different approach is instead the one oriented to *integrated* interventions, not alternative, of the promotion of health at work, after having pursued, at first, the objective of *primary prevention*. Considering groups of employees (individuals as a whole, community), with whom to build a pathway of well-being, is in fact coherent with the first objective of primary prevention.

A choice of accurate *organizational knowledge* of work itself is indeed necessary to recognize the reasons for the configuration of the innumerable possible risks (not only the psychological or social ones). It is also essential “to grasp the different dimensions of origin of the discomfort, somehow climbing back along the ‘course’ of the suffering, up to their sources” (Rulli, 2006).

The analysis of the processes of work according to the *Theory of Organizational Action* (Maggi, 1984/1990) offers an answer to the necessity of *evaluation of risk*, even in the sense foreseen in Italy by the d.lgs. 626/1994, confirmed then then by the d.lgs. 81/2008. According to this theory, the work process is the result of choices, decisions and actions (humanly flawed, incomplete, always with possible alternatives) continually modulated and reformulated according to a “principle”, imperfect itself, of *congruence* in relation to the purposes. Therefore, the process of work can be valued not so much in terms of efficiency and effectiveness in the production (of goods or services), but in terms of relative congruence between its components, inseparable from the acting subjects. In such a way, the evaluation necessarily extends itself to the well-being, as an integrated part of the “condition” of the human being at

work, in an interdisciplinary approach, the only one that allows to consider, in their evident contemporary presence, the apparently incompatible perspectives of efficiency, effectiveness, quality and safeguard of well-being in the workplace.

This perspective of analysis is that of the O&W Program which, in many research initiatives, from the mid 80's up to now – hence, before the effect of the preventive EU framework normative on health and safety at work and well before the European Agreement on stress - has analyzed many processes of work, allowing the emergence the risk of stress, among the others, in processes of handicraft and industrial production, in the tertiary sector and in the hospital and territorial sanitary services. In each of these processes of work, the risk of stress is made evident in incongruent communications, in the coordination between individuals and activity, in conditions of uncertainty and psychic load, in relation to the conditions of exposure to physical-chemical noxious agents or to accidents' risk (see the wide bibliography in Rulli, 2011a). Thus, it was possible to provide continuous evidence, coherently with the “psychoneuroendocrine” definition of Hans Selye, not only about the potentiality of stress and unspecific psychophysical discomfort related to psychological stimuli (i.e. in the incongruences of coordination and control and in communication), but also about the verifiable possibility of stress in relation to the exposure to chemical-physical noxious agents or to situations of risk for the safety of workers, in an wide range of analysis, while avoiding the simplification of the “cause-effect” linearity and taking into consideration the perception of different forms of discomfort and suffering as “raw” indicators of stress and the need of improvement of the conditions of work.

Conclusions

Health, prevention and stress have been here interpreted according to a *logic of process*, which is a common element, a common thread that deserves some concluding remarks.

It appears useful indeed to remember the etymology of the word: *process* is a noun deriving from the Latin *processus*, that means advancement toward something, *progression*. The choice to use this term is aimed at underlining the dynamic aspects, of consequentiality and of mutual influence between many variable elements and *conditions*, in the determination of possible alternatives. Alternatives of choices, decisions, actions, if the organizational process is considered, but also physiobiological specific or unspecific alternatives, as it happens in the human organism, as a consequence of stimuli and exposures to more or less nocuous *agents*. The use of the concept of *process* meaningfully differentiates this perspective in comparison to the use of terms such as “state” (for instance “state of health”), or “result”, typically utilized within an interpretation of the reality and the physiobiology according to linear cause-effect relationships.

To define *health* as a *perfectible process of well-being*, expression of the encounter between individual and collective aspirations, in evolution with the environment (also of work), to define *prevention* as a *perfectible process*, and not simply as an action or a specific intervention in the pathway that conducts to illness, to damage, finally to define *stress* as a *psychoneuroendocrine-immune process*, to underline its varying development aspects, represent a point of view and a precise epistemological choice. This allows a much wider approach, although complex (but also unitary), both for the understanding of the reality, and because it offers concrete possibilities to orient and choose among alternatives, and to modify, exactly within a perspective of well-being and of prevention.

This explanatory perspective was born out of the necessity to provide answers to crucial matters in the biomedical reflection, not only those implicated by the concepts, also intuitive, of health and prevention (what do we mean by health and prevention?), but also to give answer to questions such as what is stress, what effects it has and what measures exist to reduce its potential harmfulness. When we speak of stress, we are also invited to reflect on the not-specificity, and, therefore, on the “harmfulness of the work as a whole”, as we often use to repeat without succeeding in explaining its deep meaning and the

implications in terms of primary prevention. Such perspective, to be understood as *means* to observe the reality of health and illness (not as “model” of health and illness, to which such concept is evidently inapplicable), also allows to overcome points of view where “objectivity” is opposed to “subjectivity”, which is indeed a result of the biomedical reflection, based upon the knowledge of the relationships between the human physiobiology and what is directly or indirectly able, specifically or not specifically, to interact with the human being (also, but not exclusively, through the cognitive involvement). This perspective is not less in debt with the encounter and the stimulus offered by the capacity of interpreting reality, and by the capacity of analysis of work processes, offered by the Organizational Action Theory which allows, through opportune methods and tools, to describe and to interpret, and therefore to appraise, the process of work and the *organizational etiopathogenesis* of risk (Maggi, 1990): not only in terms of efficiency and effectiveness in the production of goods or services, but rather in terms of relative congruence between its components, not separable from the acting subjects and from their conditions of well-being.

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