

Stress: A Nonspecific Factor in Emotionality

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The perception of emotion is markedly influenced by the biochemical sequelae of stress. Therefore, stress whether induced by psychologic threat, infection, tissue injury, hypoglycemia, allergy, anemia, or hypotension influences mood and level of anxiety.

There exists today in much of psychiatry a disconcerting paradox. We trace in exacting detail the means by which noxious experience is transduced by the nervous system into biochemical phenomena which affect every aspect of the body. Profound changes in emotionality and physical functioning are thereby accounted for. Despite our assertion that there is a chemistry of emotion, we ignore and at times deny that similar chemical states will be accompanied by similar emotional states.

Nowhere is the paradox more evident than in our response to an infant of four months who awakens screaming at night as compared to our response to the same child screaming at night two years later. In the first instance, we assume the child is hungry. In the second instance, we assume the child had a frightening dream. Did the cause really change, or did our formulations do the changing? Are terrifying dreams the cause of the

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discomfort, or is the dream content influenced by physiology? Such an influence is not really strange for the perception of a full bladder is known to influence dream content.

A review of history affords some insight into our present state. Freud, whose first love was the biological sciences, found it necessary to practice medicine (neurology) in order to support himself and his family. At that time a majority of patients consulting a neurologist did so because of emotional distress. Disappointed by the electrical treatments and the capricious bromine medications then in vogue and knowing that the biological sciences were too primitive to explain emotional phenomena, he followed the lead of Charcot, Bernheim, and then Breuer first to hypnosis and subsequently to emotional catharsis. The towering contributions that evolved from his efforts established his methods as the yardstick of virtue by which all must be measured. Those who deviate from Freud's methods frequently recognize his pre-eminence by saying, "My training was psycho-analytically oriented, but . . .".

Psychiatrists with a bent for physiology have generally confined themselves to authenticating the Freudian perspective by tracing the transduction of external stimuli into adrenergic and cholinergic system activities and by

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exploring the emotional ramifications of the brain stem and limbic system.

Selye (1950) and other physiologists have delineated the following chain of events: Noxious stimulus, enhanced adrenergic outflow, release of epinephrine and norepinephrine peripherally along with release of adrenocorticotrophic-releasing substance in the hypothalamus, augmented release of adreno-corticotrophic hormone (ACTH), and augmented release of corticosteroids. Epinephrine and corticosteroids have profound acute and chronic effects on somatic gross functioning and on numerous enzymes. This familiar chain of events is often referred to as the general adaptational syndrome. It is a generalized stress response.

Epinephrine has a peripheral alerting effect which is followed by a central depressant effect (Breggin, 1965). The latter is delayed 30 to 60 minutes by the blood-brain barrier (Draskoci et al., 1960). Epinephrine initiates a conversion of muscle glycogen to lactic acid which is followed by a rise in blood lactic acid (Cori and Cori, 1928). Pitts and McClure (1967) were able to induce anxiety attacks in neurotic patients with I.V. lactic acid and to a lesser extent with epinephrine. Grosz and Farmer (1972) have subsequently attributed this effect to secondary metabolic alkalosis.

Working with adrenalectomized and hypophysectomized rats, Weiss et al. (1969) demonstrated an increased wariness which was apparently enhanced by ACTH and reduced by cortisone.

Among its many functions, cortisone is necessary for the conversion of norepinephrine to epinephrine in the adrenal medulla by phenylethanolamine -N-methyl transferase (PNMT) (Wurtman, 1967). This is promoted by the portal-type venous drainage from the adrenal cortex through the medulla. Although both norepinephrine and epinephrine are produced in the mammalian brain, the concentration of the latter is far less than that of norepinephrine, apparently because of the reduced concentration of cortisone in the peripheral circulation as compared to the adrenal medulla. Chronic stress and

exogenous cortisone would reduce the differential somewhat. It is not known whether this effect is related to the depression that accompanies chronic stress. It appears very unlikely that PNMT is the only central nervous system enzyme affected by corticosteroids. It is apparent that changes in 17-hydroxycorticosteroid secretion accompany changes in depressive states (Bunney and Fawcett, 1969). What is not clear are the precise means by which its many effects are produced. Funkenstein (1956) suggests that a norepinephrine-like substance is associated with anger and an epinephrine-like substance is associated with anxiety and depression.

From the above it appears that changes in physiology regularly occur with changes in the secretions of the pituitary-adrenal axis and that the effects of these changes constitute an important part of the perception of emotion.

Since these perceived changes are dependent upon changes in the biochemical substrate, does it not follow that similar changes would be perceived similarly regardless of how they are induced? Let us examine several ways in which similar changes may be induced.

The stress response may be triggered by perceived threat (internal or external), infection, allergy, hypoglycemia, tissue injury, hypoxia, and hypotension.

Infection as an inducer of emotional change is familiar to most of us who have witnessed postinfluenzal depression. I have seen a mildly hyperactive, nine-year-old child who became markedly so for three days after a swift recovery from acute lymphangitis for which he received oral penicillin without apparent adverse physical effect. This effect of infection may have been the kernel of truth that prompted the wholesale extraction of teeth during the 1920's and 1930's in an effort to relieve mental illness.

Dohan et al. (1969) in a double-blind study that has been ignored by most of the psychiatric profession, demonstrated a noxious effect induced by gluten in hospitalized schizophrenic patients. Gluten is a protein common to the cereal grains excepting rice and corn. This reaction seems to be a form of delayed

hypersensitivity.

Weiss and Kaufman (1971) presented six cases of children who were profoundly affected by food allergy. Their symptoms ranged from increased hyperactivity through aggravation of schizophrenic-like syndromes. Estimates of allergy in children range up to 20 percent of the population. Since allergy is often subtle and since it is not usually considered to be of emotional significance, it is most frequently overlooked.

Hypoglycemia is a ubiquitous stimulus in that carbohydrate (CBHT) homeostasis is heavily dependent on epinephrine and glucocorticoids to mobilize fat, muscle, glycogen, and protein when meals are missed or delayed, to speed gluconeogenesis, and to neutralize insulin following moderate to heavy CBHT ingestion, absorption, and storage. Hunger is used to induce restlessness and thus exercise in zoo animals. Clinically most psychiatric patients seem adversely affected by fasting.

The reaction to acute tissue injury is overt and stimulus-associated. It is unlikely to be overlooked. Nevertheless, it often given rise to useless arguments that the emotional response is because of symbolic threat rather than manifest trauma plus perceived threat.

Hypotension appears to be an iatrogenic cause of emotional distress. I have known a rather truculent, hypertensive woman in her early 40's who twice developed anxiety attacks and secondary phobias on a reserpine-containing preparation that produced mild (90/60) hypotension. Since then, I have seen several patients whose hypotension-induced anxiety required that medication be reduced before improvement could occur. One often sees hospitalized patients who experience moderate to severe anxiety concomitantly with hypotension induced by psychotropic drugs. Because their original symptoms are also overt, it is more difficult in their instances to be certain if hypotension triggered the increased symptoms. Adrenergic activation also occurs in the presence of anemia and in hyperthyroidism.

Because stress of somatic origin can produce changes in mood and levels of anxiety, it potentiates psychologically induced stress and complicates interpersonal relations. Because

somatically induced stress may be triggered several times each day, it often becomes the major stress component. To overlook stress of such magnitude places one in the classic position of shoveling sand against the wind and tide. Therapy becomes a stalemate with both patient and therapist becoming increasingly disappointed, disillusioned, irritated, and embittered. We must learn to use the physiologic insights of the last 45 years along with the psychological insights of the earlier years of this century.

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