THE ANATOMIC SEAT OF THE EMOTIONS: A DISCUSSION OF THE JAMES-LANGE THEORY*

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It is now thirty years since Prof. William James and Professor Lange independently stated their theory of the mechanism of the emotions. This theory has never been satisfactorily proved or convincingly refuted.

JAMES-LANGE THEORY OF EMOTION

The theory, as stated by James is, briefly, that the mental state experienced in emotions of fright, anger, joy, etc., is due to different sensory impulses sent up from the muscles, viscera, blood vessels and the periphery in general. It is the palpitations, tremors, abdominal qualms and other peripheral disturbances which cause the emotion. "One is afraid because he runs; he doesn't run because he is afraid." "One is pleasant because he looks pleasant." These are rather exaggerated illustrations. Attempts have been made to strengthen this phase of the theory by obtaining the opinions of great actors as to their real emotional state when they were expressing emotion. The inquiry did not help the theory, for the experiences were conflicting.

It may be interesting to return to the neurologic quest for which James first appealed, and to see whether later experience throws any light on the subject.

Professor James thought that if he could find a case in which a person was anesthetic both without and within, and if such a person felt no emotion, it would support his theory. He did find three cases of this kind, but they were not adequately reported and not considered evidential. The subject appears never to have interested neurologists very much. Of late, however, such interest has been aroused because of the emphasis that is being placed on emotion as a pathogenic agent, and also as a kind of measure of cultural progress, for it has been noted that where emotion dominates, civilization halts or disappears. With this increased attention to emotional factors, there has come a leaning to the view that the James-Lange theory or some modification of it is true. Some seem to think that it is the perturbations of

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function in the splanchnic or vegetative nervous system that especially arouse the mental experiences in emotion. Others suggest that in addition the endocrine glands and the hormones are important peripheral agents in arousing emotional states.

On the other hand, Sherrington reports one experiment, on a dog, in which he severed the cervical cord and the vagi, and found that he could still arouse evidence of emotion in the animal. This, however, is only one case and is not convincing.

The possibility of finding such cases of anesthesia as James was looking for is very remote. They could only be aroused by an extensive double lesion of the thalami. I have seen a case of complete one-sided anesthesia due to such a lesion, but with no special emotional disturbance. Sometimes a thalamic lesion causes paralysis of emotional facial expression, without particularly disturbing the emotions. One can fairly assume that if there were a double thalamic lesion causing such paralysis, the patient would feel the emotion associated with laughter or tears, without any peripheral muscular movements, and consequently no afferent reaction from the somatic system, at least. Such a patient would feel joy or fright, but could not express it in any of the ordinary muscular movements. In so far as they go, these facts tend to disprove the James-Lange theory.

If an object suddenly arouses an emotion of fear, for example, efferent impulses must be sent to the periphery before afferent impulses can be sent back. In neurologic experience we do see cases in which this efferent part of the reflex process and sometimes both pathways are very largely blocked. It is cases of this kind that I wish to report and to interpret.

Before going further let me state what meaning is attached here to the technical terms used in discussing our subject.¹ The characteristics of emotion, as described by James, in 1890, fit very well into the description of today. We say, as James virtually said, that an "affect" of "feeling tone" is something connected with sensation and has a peripheral origin. The appetites, desires, the sense of ill-being or well-being, hunger and fatigue are associated with one or more of

1. The brain-stem to which I refer later is generally described (Villiger) as including the medulla, pons and corpora quadrigemina. Tilney in his "Form and Function of the Nervous System" includes the optic thalamus. There is a difference among writers in the terms used in describing the sympathetic nervous system. The more common nomenclature is that which calls the "sympathetic nervous system" that part which is connected with the dorsolumbar portion of the spinal cord. The autonomic or "parasympathetic nervous system" is that which comes from the midbrain, medulla (vagus) and sacral part of the spinal cord.

our now estimated twenty-three special and general sensations. They are "feelings" or "affects."

An emotion, however, is always connected with a percept, idea or concept which arouses one of our primitive instincts, these being mainly variants of fear or love.² There is, said James, always a bodily sensation with emotion and generally some motor bodily reaction which has about the same pattern for the different emotions; that is, all persons react in about the same way motorially to fear or to joy or to anger. James emphasizes the fact that with emotion, at least with all the primal emotions, a person has some bodily sensation, such as a thrill, tremor, palpitations, abdominal qualm, faintness, etc.

EFFECT OF SOMATIC OR SKELETAL MUSCLES AND SYMPATHETIC SYSTEM ON EMOTIONAL STATES

Returning now to the James theory, I wish to present certain clinical facts, which seem to me to show that the somatic or skeletal muscles and sympathetic system proper have at least nothing but a minor and contributing effect in arousing the conscious emotional states.

I had a patient, a very intelligent woman of 40, who fell from a horse and broke her neck at the third and fourth cervical level. She was completely quadriplegic and suffered complete loss of cutaneous and deep sensation from the neck down—with abolition of all deep reflexes. A roentgenogram showed the presence of the fracture.

She lived for nearly a year, and during that time I saw her showing emotions of grief, joy, displeasure and affection. There was no change in her personality or character. The only skeletal muscles at her command were the cranial, the upper cervical and the diaphragm. As for the vegetative nervous system, she had the vagus, but the vagus has no active (low-level) sensory fibers except the laryngeal. The parasympathetic system in this patient was able to function, but the sympathetic proper was absolutely eliminated from subconsciousness and consciousness. It is difficult to understand, on the peripheral theory, why there should have been no change in her emotionally, with the skeletal system practically eliminated and the sympathetic entirely so.

Such a case as this is not so uncommon; I have seen others with similar symptoms, and they are very familiar to neurologists, but the reported case was unique in that the patient lived so long in such a normal mental condition.

Turning to other neurologic fields, we have all seen patients in the terminal stage of tabes, with perfectly atonic, anesthetic and greatly wasted skeletal muscles. In my experience their emotional reactions were present and not abnormal.

2. McDougal enumerates six instincts with associated emotional states.

I had once in the hospital a patient with family periodic paralysis, who for a few days was completely paralyzed except for the muscles of mastication, deglutition and respiration, but with only the natural emotional and mental changes.

In the finally complete bodily immobility and paralysis of certain forms of progressive muscular atrophy, in the absolute bodily rigidity of terminal arthritis deformans, and in the advanced stages of paralysis agitans with rigidity, all muscular movements are practically eliminated, except those moving automatically and those under the influence of the vegetative nervous system. It is at least my experience that in these patients the emotional reactions are present and normal to their condition. In all these cases the vagus system is able to act, but not the somatic, and in some cases not the sympathetic.

It does not always follow that because a sensation is felt in the periphery it is due to peripheral irritation. We can have pains in the face or arm from lesions of the thalamus, and we can have thalamic paresthesia and dysesthesia. This is shown in lethargic encephalitis and in thalamic and midbrain diseases. The dysesthesias of Parkinson's disease may be in part cerebral. In fine, we know that some of the bodily sensations, such as are sometimes associated with emotion, especially anxiety states, may be central and thalamic; so that the fact that with emotion bodily sensations are felt does not prove that they come from the periphery.

Expressions of emotion, in the form of tears and laughter, occur automatically in lesions of the brain-stem and thalamus. These outbursts are not usually associated with any real emotion of sorrow or joy; and an argument based on these cases can be made both for and against the view of a peripheral source of emotion. Thus, if the source of the emotion is peripheral, why does not the man with a thalamic lesion who bursts into laughter or tears, have eventually a real emotion of joy or sorrow, since all the somatic and splanchnic changes that accompany emotion are present? On the other hand, if emotion is of central origin, why does not the person with a thalamic lesion have emotional states as a result? I would answer in the latter case that it is because in thalamic lesions there is a rupture of the relations between the thalamus and the cortex, for there must be a corticothalamic and thalamocortical activity in the emotional experiences.

A person may have a palpitation of the heart or a sense of faintness or tremor or sweating without experiencing any emotion of fear or apprehension, unless finally the idea that he is in physical danger comes to the mind. This fact is explained by various psychologic mechanisms. It seems most reasonable to suppose that when a palpitation is felt the emotion of fear develops, because an association process

arouses an idea of illness, and this causes an emotion of fear. The mechanism of an "associated conditional reflex" may also be effectively invoked in explanation.

Finally, neurologic experience also throws doubt on a certain psychologic view, lying close to the James-Lange theory, to the effect that thought and emotion are always at once reflected out upon the muscles which in turn react and return afferent impulses to the brain. The statement is made that "we think with the muscles" because every thought is accompanied by muscular movement and every muscular movement arouses some "feeling." The muscles of the larynx and articulation are assumed to do this in particular. Even in abstract thought or meditation some slight muscular action is assumed to occur in the fine muscles of the larynx.

The neurologic experience is, however, that a person continues to feel and think perfectly well after the larynx has been removed or paralyzed and also when there is a complete muscular paralysis.

AUTHOR'S THEORY OF EMOTION

On the whole, I am led to the conclusion that emotion is centrally located and results from the action and interaction of the cortex and thalamus. The bodily sensations which accompany emotion are produced by stimuli from the automatic centers in the brain-stem (acting on heart, blood vessels and glands), but they only cooperate to extend and perhaps intensify the emotion. For naturally, if a man finds his heart palpitating, his hands cold and wet, his legs weak and his epigastrium calling out in distress, he will feel more alarm. On the other hand, if the automatic stimulus produced by joy at the sight of the beloved, strengthens his heart beat, raises his blood pressure and in general improves his sense of well-being, he will feel a little happier for it.

The centers that control the activities of the vegetative system are mainly in the brain-stem.³ These centers are first appealed to when the animal perceives something calling for instant action in defense, offense or active desire. They, on the other hand, stir up the muscles, viscera and glands, but they also appeal through the thalamus to the cortex and arouse the emotions appropriate to the object recognized or idea that has been aroused. As the suprasegmented nervous system develops, emotion develops.

3. In a recent address before the New York Neurological Society Prof. Walter B. Cannon presented evidence to show that the center for sympathetic discharges occurring on pain-stimulation lies in the brain-stem as high up as the anterior corpora quadrigemina.

I am inclined to the opinion, then, that the James-Lange theory of emotion is true only in part; that is, that the peripheral visceral stimuli are only later and contributing factors to emotion, and that the skeletal muscles and sympathetic system do not play an essential part.

I am not presenting all the data possible bearing on this question. The experiments and operations on the sympathetic ganglions, for example, show that the cerebrum can get along quite well without them or without there being much connection between these ganglions and the central nervous system. Arguments against the peripheral theory also have been presented based on studies and experiments with the glands of internal secretism. I do not attempt to introduce these data which will be found in the literature of endocrinology.

My object has been to present some facts with deductions therefrom and to elicit further contributions from the experience of neurologists.