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Emotional aspects in the etiology of bronchial asthma

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THE EMOTIONAL ASPECTS IN THE ETIOLOGY
OF BRONCHIAL ASTHMA

A Thesis
Presented to
the Faculty of the College of Medicine
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In Partial Fulfillment
of the Requirements for the Degree
Doctor of Medicine

by
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CHAPTER I

INTRODUCTION

The management of bronchial asthma is often unsatisfactory, perhaps because of an unsure understanding of the etiological factors involved. Two basic mechanisms of etiology have been generally accepted, one being called variously allergic, extrinsic, or known, and the other being non-allergic, intrinsic, or unknown (26). This paper is a review of the literature on bronchial asthma, with regard to a specific aspect of the non-allergic etiology, namely, the emotional component.

Historical Background

Theories which have placed emotions among the causative factors of asthma have been known at least since the time of Hippocrates, who acknowledged that the asthmatic might control his disease better if he could first control his temper (20). The importance of this "nervous factor" has long been debated, and medical opinion upon this point has fluctuated from one extreme to the other. Prior to this century, asthma was generally felt to be largely psychogenic in origin; then, in the nineteen-twenties, allergic theory seemed to become dominant. After World War II, interest was again turned toward emotional factors,

leading to such things as searches for the "asthmatic personality" (5). Present trends appear to lie somewhere between these two extremes. Peshkin has postulated that in the great majority of cases, bronchial asthma is brought on initially by an antigen-antibody reaction, and emotional components may then be added to the complex (25).

Purpose of This Paper

Current literature shows considerable variation of opinion concerning the importance of the emotions in asthma. Authors whose backgrounds lie more in psychiatry and psychosomatic medicine generally stress the role of emotional factors, while those who are more allergy-oriented tend to give less significance to this aspect. It is likely that a similar duplicity exists throughout clinical medicine in the attitudes of practitioners toward the role of the emotions in asthma.

In order to increase the understanding of the underlying causes of this disease, the purpose of this paper shall be to attempt to assess the degree to which emotional factors enter into the etiology of bronchial asthma.

CHAPTER II

A NEUROPHYSIOLOGY REVIEW

A Definition of Bronchial Asthma

To establish a logical basis for an emotional etiology of asthma, a brief review of the physiology involved in the influence of the central nervous system upon the bronchial tissue is in order. First of all, a statement of the definition of bronchial asthma may be of value for clarification of the mechanism: this is a disease of airway obstruction characterized by recurrent acute attacks of wheezing, expiratory dyspnea, cough, and mucoid sputum production; the obstruction is felt to be due to bronchospasm, edema of bronchial mucosa, increased bronchial secretions, dilatation of bronchial or pulmonary blood vessels, and possible hypertrophy of the bronchial wall (22).

Autonomic Physiology of the Respiratory Tract

The innervation of the bronchial mucosa is derived from both sympathetic and parasympathetic sources. The sympathetic supply is principally from the inferior cervical and upper thoracic sympathetic ganglia, while the parasympathetic portion comes from the vagus nerve which originates in the convergence of multiple rootlets from the brainstem (34).

Sympathetic influence on the respiratory tract consists of bronchodilatation and mild blood vessel constriction. Parasympathetic effect is three-fold:

1. Stimulation of the motor fibers of the vagus nerve activates the bronchoconstrictor muscle, resulting in narrowing of the lumina of the trachea and bronchi.
2. The mucous glands of the bronchial mucosa, which receive only parasympathetic innervation, respond to vagal stimulation with an increase in mucous secretion.
3. A minor vagal effect is that of slight blood vessel dilatation in the mucosa.

From the previously stated definition of bronchial asthma, it becomes evident that the respiratory tract changes found in this disease might come about as the result of excessive parasympathetic stimulation.

Kuntz proposed a system of reflex stimulation of the parasympathetics to the respiratory tract. He suggested that the presence of excess mucous in the bronchi causes stimulation of the parasympathetic afferents, which produces a reflex impulse back through efferent fibers; the efferent stimulus then results directly in bronchoconstriction and further increased mucous secretion (15). Thus, regardless of the original cause of the bronchial mucous, a vicious circle of airway obstruction might be initiated.

Cerebral Effects on Respiratory Tissue

To properly place the role of the emotions in this

scheme, a mechanism must be established whereby the brain may, as a result of environmental stimulation, produce a significant degree of parasympathetic activity in the respiratory tract. The identification of any specific environmental stimulus is not important for the present discussion; the point to ponder is whether or not the cerebral cortex can process perceptual material in such a way as to initiate a series of steps which may result in the symptoms of asthma.

Certain normal physiologic activities have a somewhat parallel application to the proposed cerebral influence on the bronchi. It is generally acceptable fact that external stimuli can produce the phenomenon we call blushing, a result of autonomic action originating with the perception of an "embarrassing" comment or situation; it might be noted that certain individuals blush more easily than others, and one might theorize that such an individual has more accessible channels from cerebral cortex to autonomic effector area. A second example of a common physical response to perceptual material is seen in the cephalic phase of gastric secretion, when the sight, smell, or the thought of food causes increased gastric secretion through impulses originating in the cerebral cortex or in appetite arousal centers located in the hypothalamus or amygdala; these impulses are then

transmitted to the gastric mucosa through the vagi (6, 10).

Other autonomic responses to perceptual stimuli are well-known, such as the marked vasodilatation seen in neurogenic shock--fainting due to extreme fright, or upon hearing shocking news, or perhaps at the sight of blood. Possibly of special pertinence to the subject at hand are the familiar respiratory changes which are seen in response to certain central stimuli; for example, the sudden inspiratory effort which is elicited by a sudden fright is familiar to all, as is the generally increased respiratory rate experienced in tense or exciting situations.

Anatomical Structures Involved in Emotion

Several anatomical relationships are important in considering the effects of emotion on the pathogenesis of bronchial asthma. Papez identified certain key structures which he felt represented the anatomic basis of the emotions; these are the hypothalamus, anterior thalamic nuclei, gyrus cinguli, hippocampus, and their interconnections, and they are the principal structures which make up the old limbic system (23).

Papez suggested that the mamillary body serves as a connecting structure between the cerebral cortex and the remainder of the hypothalamus. The circuit formed here could, according to the Papez theory, transmit impulses

originating both in cerebral and in hypothalamic centers in the following manner:

1. Emotional impulses of cortical origin build up in the hippocampal formation, then go via the mamillary body to the anterior thalamic nuclei, and thence to the gyrus cinguli.
2. Many different peripheral sources cause visceral and somatic sensory impressions which exert influence on the hypothalamus; the impulses are mediated and sent into the mamillary body, then pass on to the gyrus cinguli.

Papez felt that the gyrus cinguli serves as a receptor area for the experiencing of emotion, and that emotive processes radiate from this area to other regions of the cerebral cortex to add emotional coloring to all psychic activity.

Ward hypothesized a somewhat different mechanism involving most of the limbic structures. He felt that emotional activity in the reticular arousal system sends impulses through the fornix into the hippocampus, and then pathways similar to those of Papez are utilized. Involvement of the reticular arousal system would, in Ward's opinion, incorporate a degree of emotional tone in all phases of thinking, since the arousal system must be active in order for cortical thought processes to continue (29).

The importance of the hypothalamus in emotional activity has been noted by many authors (17, 23). MacLean observed that the hypothalamus is responsible for the neural control over systems which mediate visceral actions

accompanying emotional behavior; however, he also pointed out that the hypothalamus integrates emotional action only, leaving the capacity to "feel emotion"--affective experiences such as sorrow, love, joy, fear and anger--to the cerebral hemispheres (18).

The hypothalamus has strong autonomic associations, some of which influence respiratory activity. The dorsal nucleus of the vagus is the source of preganglionic parasympathetic fibers to the lungs, and is also the recipient of visceral afferent fibers from respiratory tissue. This nucleus then has connections with the hypothalamus, as well as with other nuclei in the reticular formation (9).

Although the precise anatomical-physiological pathways involved in the mechanism of the effect of the emotions on bronchial asthma may not be completely identifiable throughout the structures of the brain, the potential connections between bronchial mucosa and central centers of emotion are apparent.

CHAPTER III

EXPERIMENTAL STUDIES ON ASTHMA AND EMOTIONS

Animal Experiments

Many animal experiments have been reported pertaining to the role of emotional factors in asthma. Ottenberg, in an example of classical conditioning, sensitized guinea pigs to egg white with intraperitoneal injections, thus producing the symptoms of asthma; he was then able to cause asthmatic attacks in these animals by placing them in a chamber and spraying them with an aerosol mist containing egg white. The guinea pigs were then placed in the chamber without any egg mist, and some of them exhibited a "learned asthmatic response" (21).

Other conditioning-learning experiments, somewhat similar to the one above, have been done with sheep, goats, monkeys, and other animals (19). Results have generally indicated that symptoms of bronchial asthma can sometimes be produced through nervous, learned, conditioned, or perhaps even emotional stimuli.

Human Experiments

Numerous experiments regarding an asthma-emotion connection have been performed with human subjects, and

although in some cases conclusions have been based on small samples, or studies have not been well-controlled, the composite of results certainly lends credence to an emotional mechanism in asthma. Several of these studies will be briefly reviewed here, dealing with bronchial asthma specifically, and also with more general material such as attitudes and personalities as they relate to respiratory disorders.

Graham and his associates theorized that in a number of psychosomatic diseases an association could be made between the patient's attitudes and his specific illness. Attitudes were determined, in this study, by single interviews of hospitalized patients. Bronchial asthma patients were categorized as generally feeling left out, unloved, and disapproved of, and tending to avoid dealing with situations (8).

Jacobs and his group studied twenty-nine male college students suffering from upper respiratory infections and compared their personalities with those of twenty-nine "healthy" college men as controls; conclusions here were that the students with the respiratory infections were generally more aggressive, had more difficulty in accepting failure, and probably tended to "use" their illnesses as acceptable methods of escaping from unpleasant situations (13).

Luparello evaluated baseline airway resistance in asthmatics, and then had these subjects inhale a mist consisting of physiologic saline, telling them that they were inhaling particles of an allergen; the patients were under the impression that they were being given increasing amounts of a known allergen to breathe in order to find their "allergic threshold." In many of these people, wheezing and dyspnea appeared, and a repeat test of respiratory function showed a definite increase in airway resistance. The subjects were then told that a bronchodilator substance would be put into their inhalant mist, to counteract the "allergen," and saline solution was again substituted. One hundred per cent of those who had experienced wheezing and dyspnea had their symptoms relieved (16).

Dekker and Groen investigated the significance of psychogenic factors in asthma on twelve patients, using vital capacity as the parameter of respiratory function. After establishing a baseline vital capacity, each patient was exposed to an emotional stress; the particular stress was selected by finding in the patient's history some situation which regularly seemed to precipitate attacks. The patients reported a variety of stressful stimuli, such as visiting the grave of a parent, listening to the national anthem, looking at a goldfish in a bowl, and

seeing a picture of an asthmatic child. Each subject was exposed to his particular stress, and the vital capacity was again measured; six of these people showed no change, three showed mild transient decreases in vital capacity with mild symptoms of asthma, and three showed frank attacks with a marked decrease in vital capacity (3).

Block and associates devised a rating system for sixty-two asthmatic children, based on the five following criteria:

1. The total number of different allergies suffered.
2. The ease with which offending allergens could be identified.
3. A family history of allergy.
4. Sensitivity to skin testing.
5. Blood eosinophil count.

Children scoring high in these five categories were said to have a marked predisposition toward somatic allergy; those with low ratings were categorized as having a more non-allergic form of disease. The two groups so defined were then compared with respect to psychopathology present, both in the children and in their mothers. Those children with a low degree of allergic component in their disease were found to show significantly more psychological abnormalities than those who were highly allergic; likewise the mothers of the children with low allergic potential showed greater degrees of psychopathology than did the mothers of the more allergic children (2).

Purcell, Bernstein, and Bukantz separated asthmatic children into two groups according to the degree of dependence on steroid therapy which these patients exhibited during hospitalization for asthma. One group consisted of those whose asthmatic symptoms showed remission upon hospitalization, without any steroid therapy; the second group was made up of those whose symptoms could not be brought under good control without regular doses of steroids. A comparison of the emotional components in these two groups of patients showed that psychogenic factors were more prominent in the children who showed rapid remission than in those who were steroid-dependent (27).

In addition to experiments of the type just reviewed, dealing with emotion and psychological findings, certain investigations have been carried out in human subjects regarding autonomic physiology. One of these has significant bearing on the present discussion, and has been reported by a number of different authors (12, 28, 32). This is a study aimed at emphasizing the effect of autonomic stimulation on the respiratory tract, and involves blocking the sympathetics to that area, thus allowing the parasympathetics to exert uninhibited activity. Wolf and his associates accomplished this by local anesthetization of the stellate ganglion, and found that the unopposed

parasympathetic stimulation caused moderate nasal hyperfunction and marked increase in respiratory tract reaction to any other noxious respiratory stimuli (32).

CHAPTER IV

A DISCUSSION OF EVIDENCE REGARDING THE SIGNIFICANCE OF EMOTIONS IN ASTHMA

Earlier in this century, medical opinion favored the idea that visceral symptoms cannot have psychological origins. Now, most would agree that the majority of body mechanisms, including those of the central nervous system, are interrelated (17). One might theorize that it is an imbalance or improper functioning of these otherwise normal mechanisms which may be implicated in certain cases of bronchial asthma. To test this theory, the following paragraphs will discuss the available evidence, pro and con, regarding emotional factors in asthma.

Evidence in Favor of Emotional Etiology

The previous chapter has presented numerous experimental cases in which asthmatic symptoms have been produced, in man and in animals, by non-allergic stimuli such as conditioning, suggestion, and environmental change. In addition to the experimental data, many clinical observations have been recorded which strengthen the theory of an emotional etiology for bronchial asthma. These are observations made with respect to psychopathology noted in asthmatics and their families, psychological developmental

tendencies ascribed to asthma patients, and responses of certain asthmatics to special forms of therapy.

The psychopathology of asthma patients has been a subject of great interest to many investigators. Hammarstan and Wolf noted that asthmatics do not mature properly with respect to the degree of self-sufficiency and independence they develop (11). Feingold and his group observed that asthmatic attacks could be related to an underlying conflict within the patient, based on an unresolved excessive dependence on the maternal figure (4). French, referring to patients with "psychogenic asthma attacks," said these people suffered from "...a fear of loss of the love and support of the mother or of some other figure who has played a maternal role in the patient's life" (7). Jacobs, in his study of upper respiratory disease in college students, reported that the group with upper respiratory infection was more aggressive, more defiant, and more impetuous than the control group (13).

From the preceding paragraph, one can see that opinions vary somewhat regarding any alleged "fundamental fault" in the psychological make-up of patients suffering from non-allergic asthma. While it is likely that psychological disturbances, if present, may be related in some way to parental conflict, a specific asthmatic personality defect has not yet been satisfactorily identified.

Closely related to studies of the asthmatic's personality, have been investigations into parental--especially maternal--psychopathology. Mention has been previously made of the increased incidence of abnormal psychological findings in the mothers of children with non-allergic asthma (2). A number of authors have noted a significant degree of maternal rejection in the mothers of asthmatic patients (7, 11, 20, 28). Whereas overt neglect of a child might be easily recognized, McGovern pointed out that rejection may take various, more subtle forms; it may be present, for example, in the perfectionistic parent who cannot accept the faults in her child, and so cannot give a full measure of maternal love; or, it is sometimes seen in the self-sacrificing mother who goes to extremes to give up her personal pleasures for the "benefit" of her child, thereby making the child excessively dependent upon her and subject to her desires (20).

Opposing the theory of maternal rejection, Abramson proposed that the parents of asthmatics tend to engulf, or over-protect, their children (1). Others have recorded similar views, with some suggesting that engulfment may actually be a manifestation of reaction formation in a parent who has inner feelings of rejection toward the child, and seeks to reverse these feelings by smothering the child with protection and care (31). Maternal

engulfment may sometimes be due to a mother's reaction to the loss of other children, or to excessive attention being showered on the last-born "baby of the family," or perhaps to abnormally high concentration on an only child.

Here again, specific parent psychopathology may not be constant or well-defined regarding emotionally-related asthma. It is important, however, to recognize the fact of the possible involvement of parent-child relationships in managing some of these patients.

Many asthmatics have, in the course of therapy, exhibited certain behavior which adds to the evidence in support of the emotional etiology hypothesis. Peshkin has observed that many children suffering from intractable asthma have been found to undergo dramatic relief from symptoms, apparently as a result of being separated from their parents (24). These patients have been known to show complete remission upon hospitalization, without any medical treatment; in some cases, relapses have been seen repeatedly at the time these children go home to their families. This phenomenon has been noted in various countries and climates throughout the world, which tends to shift the etiologic emphasis somewhat from such things as humidity and pollen count.

Hypnosis has been employed to a limited degree in treating certain cases of asthma, and some of the results

of this therapy are indicative of emotional aspects in the etiology of this disease. White, in a small sample of ten asthmatics, used post-hypnotic suggestions of easier breathing, decreased bronchospasm, and increased confidence, and in six of these patients noted a decrease in the severity of symptoms, with less medication required to control their disease, and less hospitalizations (30). Objective improvement in these patients was not marked, but increased subjective comfort was notable.

Evidence Opposing Emotional Etiology

While it is appropriate to give emotional and psychological factors their place in the etiology of bronchial asthma, it would be in error to emphasize their importance beyond proportion. Kleeman has defined asthma as "...a disease of multifactorial origin in which there may be psychiatric aspects in some of the patients some of the time" (14). If one includes emotional stimulus under the realm of "psychiatric aspects," this definition is quite apt for discussion here.

Peshkin has stated, "While one might speculate almost without limit about possible psychological factors, this kind of speculation is very unrewarding and often obscures the basic issues. Intractable asthma is a condition which occurs in children who have basic immunologic

allergies. The condition of intractable asthma results from a convergent pathogenesis in which several etiologic agents adversely affect the bronchial tissues..." (25).

In opposition to a theorized emotional etiology of asthma, it is important to emphasize that emotional factors cannot be used as an answer to all of the complex facets which underlie the causes of this disease.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The importance of emotion as a factor in the etiology of bronchial asthma has been a subject of some controversy. This paper has discussed experimental and clinical data, attempting to assess the significance of the role of the emotions in causing this disease. Certain anatomic and physiologic material has been reviewed in order to establish a logical basis for a hypothesis of emotional etiology.

It has been shown that parasympathetic stimulation of the respiratory tract, if excessive, can produce the symptoms of bronchial asthma. Potential pathways have been pointed out for the transmission of impulses from the cerebral cortex into the limbic system, and through the vagus nerve, giving further validity to a proposed mechanism whereby emotional stimulus might result in asthmatic symptoms. Normal parasympathetic activity in the respiratory tract most likely serves as a protective mechanism against noxious stimuli such as foreign bodies or irritant gases (33). If an individual begins to react to stressful situations in the same manner he reacts to noxious respiratory stimulation, his protective mechanism may become

over-sensitive, and asthmatic symptoms may begin to appear in response to emotional stress.

Experimentation, in man and animals, has shown repeatedly that asthmatic symptoms can be produced in some individuals by psychic stimulation. A number of clinical observations have supported these experimental findings.

A discussion of the supporting and opposing evidence regarding the significance of emotional factors in asthma has pointed out the possibility of certain psychological abnormalities in asthmatics and in the parents of asthmatics. Specific personalities associated with bronchial asthma have not been established, however, and excessive speculation about the identity of the psychological factors is of little value in the management of the disease.

Conclusions

While the evidence clearly indicates that emotional stimulation may be a factor in the etiology of bronchial asthma, all cases of this disease cannot be explained on an emotional basis. Emotional factors should be recognized as being very prominent in some patients, less so in others, and probably quite insignificant in still others.

Individual variation is a key to understanding the effects of emotional stimulation; just as some people

respond to stress with increased secretion of gastric acid, it is entirely likely that in certain individuals the target organ for stress, or emotional stimulus, may be the respiratory tract. It is also likely that in these individuals who develop asthmatic symptoms in response to emotional stress, the degree to which this mechanism functions may vary from day to day, depending upon the combination of conditions present. For example, consider the man who has developed an over-sensitive, over-protective bronchial response to stress, on a day when he has been under perhaps greater than normal pressure at work, when perhaps higher than normal levels of noxious stimulants are present in the atmosphere, and who is then subjected to some emotional stimulus--joy, fear, rage; this might represent the combination of factors which could precipitate an asthmatic attack.

It is important to point out that the individual described in the preceding paragraph is not "faking an asthma attack." Bronchospasm resulting from emotional causes may be just as serious as that caused by an allergic reaction. The management of bronchial asthma must include consideration of its psychosomatic aspects.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Abramson, H. A. "Evaluation of Maternal Rejection Theory in Allergy," Ann. Allerg., 12:129-40, 1954.
2. Block, J. H., et al. "Interaction Between Allergic Potential and Psychopathology in Childhood Asthma," Psychosom. Med., 26:307-14, 1964.
3. Dekker, E., and Groen, J. "Reproducible Psychogenic Attacks of Asthma," J. Psychosom. Res., 1:58-67, 1956.
4. Feingold, B. F., et al. "Psychological Variables in Allergic Disease: a Critical Appraisal of Methodology," J. Allerg., 38:143-55, 1966.
5. Franks, C. M., and Leigh, D. "The Theoretical and Experimental Application of a Conditioning Model to a Consideration of Bronchial Asthma in Man," J. Psychosom. Res., 4:88-98, 1959.
6. French, J. D. "Brain Physiology and Modern Medicine," Postgrad. Med., 27:559-73, 1960.
7. French, T. M. "Emotional Conflict and Allergy," Int. Arch. Allerg., 1:28-40, 1950.
8. Graham, D. T. "Specific Attitudes in Initial Interviews With Patients Having Different Psychosomatic Diseases," Psychosom. Med., 24:257-66, 1962.
9. Gray, Henry. Anatomy of the Human Body, Twenty-seventh ed., Edited by Charles Mayo Goss. Philadelphia: Lea and Febiger, 1959, p. 920.
10. Guyton, A. C. Textbook of Medical Physiology, Third ed. Philadelphia and London: W. B. Saunders Co. 1966, p.897.
11. Hammarstan, J. F., and Wolf, S. "The Role of the Emotions in Respiratory Disease," Med. Clin. N. Amer., 43:113, 1959.
12. Holmes, T. H., et al. The Nose, Springfield, Ill.: Charles C. Thomas. 1950, pp. 113-17.

13. Jacobs, M. A., Spilken, A., and Martin, N. "Relationship of Life Changes, Maladaptive Aggression and Upper Respiratory Infection in Male College Students," Abstract of paper presented at the meeting of the American Psychosomatic Society, Boston, Mar. 29-31, 1968.
14. Kleeman, S. T. "Psychiatric Contributions in the Treatment of Asthma," Ann. Allerg., 25:611-19, 1967.
15. Kuntz, A. The Autonomic Nervous System, Third ed. Philadelphia: Lea and Febiger, 1929, pp. 175-77.
16. Luparello, T., et al. "The Influence of Suggestion on Airway Reactivity," Abstract of paper presented at the meeting of the American Psychosomatic Society, Boston, Mar. 29-31, 1968.
17. MacLean, P. D. "Contrasting Functions of Limbic and Neocortical Systems of the Brain and Their Relevance to Psychophysiological Aspects of Medicine," Am. J. Med., Oct. 1958, pp.611-26.
18. MacLean, P. D. "Psychosomatic Disease and the Visceral Brain: Recent Developments Bearing on the Papez Theory of Emotion," Psychosom. Med., 11:338-53, 1949.
19. Moore, N. "Behavior Therapy in Bronchial Asthma: a Controlled Study," J. Psychosom. Med., 9:257-276, 1965.
20. McGovern, J. P., and Knight, J. A. Allergy and Human Emotions, Springfield, Ill. Charles C. Thomas, 1967
21. Ottenberg, P., et al. "Learned Asthma in the Guinea Pig," Psychosom. Med., 20:395-401, 1958
22. Norman, P. S., and Cluff, L. E. "Asthma, Hay Fever, and Other Manifestations of Allergy," Principles of Internal Medicine, Fifth ed., Edited by T. R. Harrison, et al. N. Y., Toronto, Sydney, and London: McGraw-Hill Book Co. 1966, p. 1451.
23. Papez, J. W. "A Proposed Mechanism of Emotion," Arch. Neur. and Psych., 38:725-44, 1937.

24. Peshkin, M. M. "The Role of Emotions in Children With Intractable Bronchial Asthma," J. Asth. Res., 2:181-89, 1965.
25. Peshkin, M. M. "The Emotional Aspects of Allergy in Childhood," J. Asth. Res., 3:265-75, 1966.
26. Peshkin, M. M. "The Incidence and Etiology of Asthma in Childhood," J. Asth. Res., 4:179-82, 1967.
27. Purcell, K., Bernstein, L., and Bukantz, S. "A Preliminary Comparison of Rapidly Remitting and Persistently Steroid-dependent Asthmatic Children," Psychosom. Med., 23:305-13, 1961.
28. Treuting, T. F., and Ripley, H. S. "Life Situations, Emotions, and Bronchial Asthma," J. Nerv. and Ment. Dis., 108:380-98, 1948.
29. Ward, A. A., Adey, W. R., and Pribram, K. A. "The Surgical Aspects in Behavioral Neurophysiology," J. Neurosurg., 18:371-79, 1961.
30. White, H. C. "Hypnosis in Bronchial Asthma," J. Psychosom. Res., 5:272-79, 1961.
31. Wittkower, E. D., and Engels, D. "Psychological and Allergic Aspects of Asthma," Psyche and Allergy, Edited by Michael L. Hirt. Springfield, Ill.: Charles C. Thomas, 1965, pp. 143-71.
32. Wolf, S., et al. "An Experimental Approach to Psychosomatic Phenomena in Rhinitis and Asthma," J. Allerg., 21:1-11, 1950.
33. Wolff, H. G. "Life Stress and Bodily Disease--a Formulation," Arch. Nerv. and Ment. Dis., 29:1059-72, 1950.
34. Woodburne, R. T. Essentials of Human Anatomy, New York: Oxford Univ. Press, 1957, p. 184.