though they did stain tumor tissue. The corresponding dyes in which the alkyl group on the 9-nitrogen contained more than 2 carbon atoms stained fat *in vivo*. These dyes also stained tumor tissue *in vivo*.

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Studies of Proteolytic Enzyme Systems in Patients with Emotional Disorders.* (19087)

JAMES S. L. JACOBS, PHILIP M. WEST, AND CLINTON E. TEMPEREAU.
(Introduced by C. M. Carpenter.)

From the Departments of Psychiatry and Investigative Medicine, Long Beach Veterans Administration Hospital, Long Beach, and Departments of Infectious Diseases and Biophysics, School of Medicine, University of California, Los Angeles.

Studies of protein metabolism have revealed well-defined deviations in the concentrations of certain protein-splitting enzymes in the sera of patients with cancer(1-3). This report concerns the existence of analogous enzymatic disturbances in the presence of emotional disorders. The enzymes in question are accompanied in the blood by excesses of their inhibitors. Measurements of the latter permit valid deductions referable to the particular enzyme systems. Chymotrypsin-inhibitor is one element of an enzyme system which correlates with the rate of protein destruction. For example, abnormal concentrations have been noted in the presence of cancer, infections, physical trauma and wasting diseases. The relief from anxiety afforded by prefrontal lobotomy(4) for the alleviation of intractable pain of cancer, is often followed by significant reductions in abnormally increased concentration of chymotrypsin-inhibitor. Electric convulsive therapy provides comparable results. Therefore it becomes important to know the effect of emotional status alone upon the titer of chymotrypsin-inhibitor. Under certain circumstances its concentration in the serum correlates with the intensity of emotional reaction. In a series of 102 patients, the degree of anxiety experienced by each was estimated clinically (Fig. 1.) A graded scale of 5 divisions was employed: absence of anxiety and panic represented the extreme categories; slight, moderate and severe anxiety were defined in the intermediate groups. Only schizophrenic psychotics, conversion hysterics and patients with acute anxiety states were included. A direct correlation between the degree of anxiety and elevations of chymotrypsin-inhibitor concentrations was found to exist in the last group alone. Patients with conversion hysteria exhibited no such relationships, and furthermore seldom demonstrated more than slight elevations in titer. On the other hand, schizophrenic psychotics showed highly variable enzymatic changes, some of which were directly related to the level of anxiety, while the majority were not. But, in this group high titers *were* obtained.

It then became imperative to investigate the possibility that the changes in protein metabolism might be associated with variations in adrenal function. The demonstration that the urinary excretion of the proteolytic enzyme, uropepsin, is an appropriate measure of adrenal activity, the titer directly paralleling adrenal function(5), provided a satis-

* Reviewed in the Veterans Administration and published with the approval of the chief medical director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinions or policy of the Veterans Administration.

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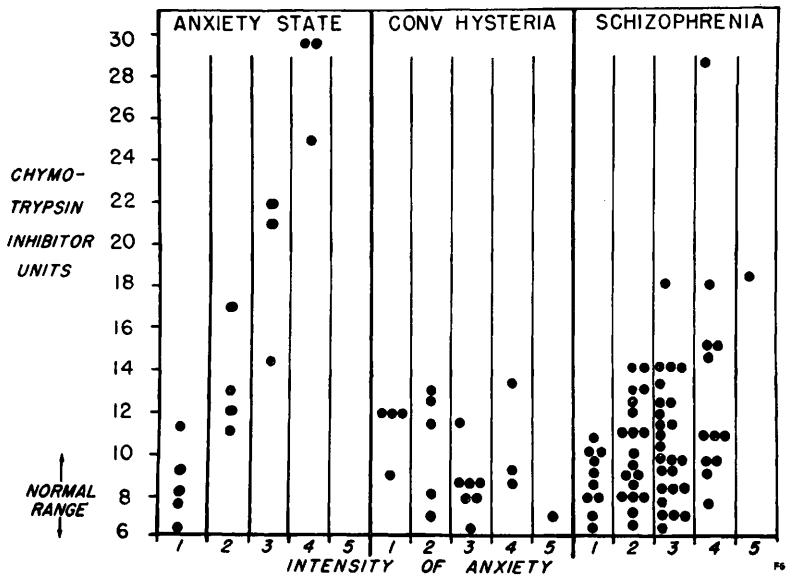

FIG. 1. Concentration of chymotrypsin inhibitor in the sera of 102 patients classified as anxiety state, conversion hysteria and schizophrenia. Each group is sub-classified according to the intensity of anxiety on a 5 point scale. (Chymotrypsin inhibitor determinations are recorded on a more sensitive scale than that described in ref. 1 and 2.)

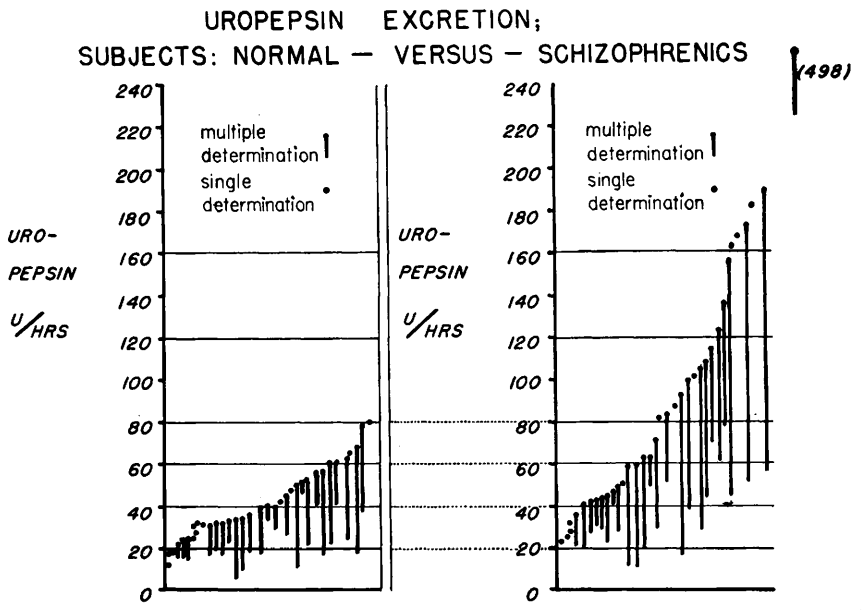

FIG. 2. Uropepsin excretion of 36 normal and 36 schizophrenic subjects. Each line indicates the degree of variation in a single subject; a dot signifies a single uropepsin determination.

factory method for this purpose. Uropepsin determinations were performed on the urines of 36 normal individuals and 36 schizophrenic psychotics; 1-15 tests were completed in each case (Fig. 2). It was found that in general the urines of schizophrenic psychotics contained larger quantities of uropepsin than did those of normals; sometimes remarkable quantities were noted. Furthermore, the output among schizophrenics was far more varia-

ble than among the controls. The data indicate that in the presence of a schizophrenic psychosis increased and highly variable adrenal activity is a common occurrence, and is apparently unrelated to psychomotor activity.

Summary. These investigations imply that emotional disorders are accompanied by changes in protein metabolism and adrenal activity. The protein metabolic disturbances are generally in the direction of increased catabolism, being well correlated with emotional response when the disorder is essentially an anxiety reaction to acute stress, less well correlated in schizophrenic psychosis, but sometimes still pronounced and, finally, lacking in correlation in the presence of conversion hysteria. Furthermore, a comparison of schizophrenic psychotics with normal controls reveals that the former exhibit a generally higher and more variable state of adrenal activity. It is hoped that these ostensibly unrelated sets of data may eventually become integrated with a coherent concept of individual reactions to stress.

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Rapid CO_2 Determination with the Beckman O_2 Analyzer.* (19088)

VIVIAN G. BEHRMANN AND FRANK W. HARTMAN.

From the Department of Laboratories, Henry Ford Hospital, Detroit.

The current daily hospital routine, which includes Tissot basal metabolism, maximum breathing capacity and exercise tests, requires from 40 to 60 expired air analyses in duplicate. The classical Haldane technic has been the method of choice for many years. Since 1947, efficiency has been increased through the innovation of O_2 analysis, based upon the paramagnetic qualities of O_2 so ingeniously devised by Pauling(1). Consequently, CO_2 has been determined as usual by Haldane, with only a complete duplicate analysis as a check on 1 out of every 10 determinations on the Beckman O_2 analyzer. To further minimize Haldane analysis, the search for a cheap, rapid, CO_2 method accurate enough for this purpose has been our objective in recent years. Infra-red spectroscopy(2,3) and the mass spectrograph(4) are especially suited to accurate, quick, CO_2 determination in continuous analysis but are elaborate and expensive. Although a variation of the simpler and cheaper venturi meter method(5) has been tried and a conductivity apparatus(6,7), which we have built into a constant temperature chamber, is now in use, the principle of

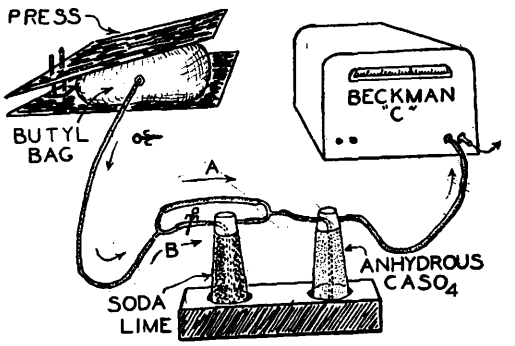

FIG. 1.

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