PSYCHOLOGICAL ASPECTS OF CARDIOVASCULAR DISEASE

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Psychological Aspects of Cardiovascular Disease[1]

Introduction

In considering the psychological aspects of cardiovascular disease four areas are discussed: (1) coronary artery disease; (2)congestive heart failure; (3) hypertension; and (4) special aspects of diagnosis and treatment. Although the reader will note psychological variables common to each of these processes, the emphasis is different in each situation. In coronary artery disease, attention is given to the precursant behavioral factors and concurrent social events. In congestive heart failure, emphasis is placed upon the interrelationship of sociological, psychological, and physiological stress factors in precipitating failure in the presence of structural myocardial or valvular changes. In hypertension, the progressive nature of the disease is considered in terms of effecting different psychosocial relationships for each stage. The section on the psychological aspects of special procedures in diagnosis and treatment discusses cardiac catheterization, cardiac pacemakers, intensive care units, cardiovascular surgery, and the new operant conditioning techniques.

The psychological aspects are discussed in terms of three phases: (1) preillness behavior patterns and personality; (2) the psychological state of the individual at the time of onset; and (3) the emotional and psychological

reaction to illness. In each of these phases, the reader will find that it is difficult to separate strictly psychological phenomenon from the physioanatomic on one hand or from the socioenvironmental on the other. Wherever possible, the interaction of these variables with one another is stressed, rather than an implied linear or causal relationship between them. The literature is identified in considerable detail not only to provide current and historical reference sources for the interested student, but also to convey the complex interrelationships that prevail. At the same time, the significance of the findings presented are discussed in terms of their relevance and applicability to clinical problems. For example, the section on Psychological Aspects of Diagnosis and Treatment identifies the increasing attention that investigators have given to the adaptational responses of patients with catastrophic illness and the significance of these in their care.

Coronary Artery Disease Epidemiological Precursors

Epidemiological Precursors

A discussion of psychosocial factors, precursant, concurrent, or consequent to the development and onset of cardiovascular and coronary artery disease begins with the work of epidemiologists. Specific factors implicated by epidemiological study are diet—including caffeine—serum lipids, elevated blood pressure, smoking, diabetes, obesity, and cultural and

genetic traits. To date, almost all of these studies have been of men. The Framingham studies conducted during the 1960s correlated cholesterol levels, elevated blood pressure and smoking with atherosclerosis. Heavy cigarette smokers experienced a three-fold increase in incidence of myocardial infarction and death from any cause over noncigarette, i.e., pipe and cigar, and former smokers. Although the study failed to demonstrate a relationship with angina pectoris, it did show a correlation of the latter with weight gain after the age of twenty-five. Other investigators have verified these relationships and suggested that smoking may act both as an independent factor and in association with other risk factors.

Paffenbarger and his colleagues have reviewed the college health records of individuals who subsequently developed cardiovascular disease, identifying eight precursors for victims of coronary disease: heavy cigarette smoking, higher blood pressure levels, excess body weight, shortness of stature, nonparticipation in athletics, early parental death, only-child status and “sociopsychological exhaustion”. Thomas, in a prospective study of medical students has found similar correlations. More recently the lower incidence of atherosclerotic heart disease in some areas of the United States has been related to the increased Lithium content in the water supply. A similar correlation has been suggested for mental illness, which is made more interesting by at least one study which suggests that patients with cardiovascular disease often have cyclothymic personalities. In a study of

young men with coronary artery disease, Hatch et al. have found that overnutrition and heavy smoking may interact with hereditary factors to accelerate the progress of coronary atherosclerosis. Among the genetic factors cited are short stature, vascular defects, and abnormalities in the intermediary metabolism of lipoproteins and carbohydrates.

Psychosocial Precursors

In a review of the psychosocial precursors of coronary artery disease, Jenkins cites and evaluates 162 studies. He sees the need for larger prospective studies to examine the psychosocial variables: behavior patterns, crisis-related disease-onset situations, and social incongruity. He suggests that these studies address themselves to four patterns of coronary artery disease: (1) survivors vs. (2) nonsurvivors of myocardial infarctions; (3) individuals with silent infarctions; and (4) patients with angina pectoris. Such studies, he anticipates, will identify relative importance for each of the psychosocial variables as related to different disease patterns. The following discussion identifies some of the correlations between psychosocial variables and coronary artery disease.

Social

Hinkle, on the basis of an earlier review of the social and biological correlates of coronary artery disease, hypothesized that diet, activity

patterns, increased latitude for social mobility, and striving behavior foster, via neuronal and hormonal mechanisms, a biochemical environment in the blood stream that accelerates atherosclerosis, facilitating occlusion of coronary arteries, impairing blood supply to the heart muscle, and making arrhythmias and death more likely. He believes that social and behavioral variables cannot be dealt with in broad general categories such as "stress" and "mobility" but must be studied as discrete, carefully limited, vigorously defined concepts or entities. Coronary artery disease is the outcome of a complex interaction of many variables in which no single one predominates. In an examination of the variables occupation and education, Hinkle and his colleagues executed a five-year survey of 270,000 Bell System employees establishing that: (1) men attaining the highest levels of management do not have a higher risk of coronary artery disease than men at the lowest levels; (2) there was no added risk for men elevated quickly or transferred; (3) men who had college degrees on entering the company had a lower attack rate, lower death rate, and lower disability rate at every age, in every part of the country, and in all departments; (4) the difference in risks exists at the time of employment; and (5) may be the result of biological differences in noncollege as opposed to college men related to social and economic background and resulting habits, e.g., smoking, diet, childhood health care.

Other investigators have studied the relationship of social class to the incidence of coronary artery disease. Friedman and Hellerstein examined this

incidence in four groups of lawyers presumably divided on the basis of economic and ethnic background. Lawyers in the highest and lowest groups had a lower incidence than those falling in the middle groups. Bruhn et al. related a lower incidence of death from myocardial infarction with the stability of the community in the comparison of a mixed ethnic town with one composed primarily of lower socioeconomic Italians. In a study of major significance, Shekelle et ah, on the basis of a prospective study of 1472 middle-aged male Caucasians free of coronary heart disease, concluded that the incongruities in social status are associated with the risk of coronary heart disease. They demonstrated that the incidence increased as the number of incongruities per subject increased. Men with four to five incongruities had six times the risk compared to men with no incongruities. This finding was not explained by correlations with serum cholesterol, arterial pressure, blood glucose, age, educational status, weight, or cigarette smoking. An interesting relationship was observed between level of education and manifestation of cardiac symptoms with men in the highest and lowest strata manifesting angina pectoris as opposed to the middle strata where symptoms and signs of myocardial infarction prevailed.

Caffrey, in a retrospective study of monks with myocardial infarctions, emphasized that a profile of scores relative to a number of factors is of greater significance in ascribing possible etiogenicity than single factors. For monks, he suggests that such a profile including behavior pattern type A, i.e., a

moderately high level of responsibility, a family background of lower socioeconomic status, a fairly sedentary occupation in one who has previously enjoyed a good deal of exercise, related to a greater likelihood of myocardial infarction. Cassel et al. comparing a prevalence vs. an incidence study among rural Georgians concluded that the previous high association of coronary artery disease in higher social class white men as opposed to lower rates for lower-class blacks was gradually disappearing presumably because of the increasing behavioral similarities in the two groups, especially among the younger men.

Behavioral

Since 1958, Friedman and Bosenman and their associates have published extensive retrospective and prospective surveys relating a behavior pattern, identified as type A, to coronary artery disease. In their initial studies, they correlated behavioral factors including intense ambition, competitiveness, constant preoccupation, the stress of occupational deadlines, and a sense of urgency with elevated serum cholesterol, increased blood clotting, *arcus senilis* and clinical coronary artery disease. Subsequently, they have measured the physiological reactions of subjects listening to a specially designed tape recording of two monologues, noting that individuals designated as type A manifested greater respiratory excursions, more frequent clenching of fists and body movement on listening to a dull, hesitant,

monotonous, repetitive monologue as compared to individuals identified as having a type-B behavior pattern. In a later, retrospective analysis of prospectively obtained data, 80 of 113 men who developed coronary heart disease or higher serum alpha lipoproteins had been rated as exhibiting behavior pattern type A. In a two year follow-up study, 70 of 3524 employees developed coronary heart disease as demonstrated by infarction or angina. All of these had initially shown an abnormal lipoprotein pattern, hypertension and/or type-A behavior pattern. Of the three, the latter was the single most constant factor. In contrast to the high risk of coronary artery disease identified for type-A behavior, they established a substantially lower risk for a type-B behavior pattern, presumably the converse of type A. A man with type B was considered to be essentially immune to the development of clinical coronary heart disease if he exhibited a serum cholesterol level less than 226 *μg*./100 ml., a serum triglyceride level less than 126 *μg*./100 ml. or a serum B/ 00 lipoprotein ratio less than 2.01 singly or in combination. On a study of the vasculature of type A and type B succumbing to death for whatever cause, they identified that the former exhibited severe coronary atherosclerosis six times more frequently than the latter. In a recent review article of their findings, a more graphic description for the individual with type-A behavior is suggested as a coat of arms showing a clenched fist wearing a stop-watch. The association of coronary artery disease and type-A behavior is associated with parental coronary artery disease, elevated

cholesterol, cigarette smoking, and elevated diastolic blood pressure. The possible role of the hypothalamus is suggested. Electrical stimulation of the diencephalon and lesions in the fornix, medial portion of the lateral hypothalamus and either ventromedial or dorsomedial nucleus have produced transient and persistent elevations in plasma cholesterol levels in rats. These elevations have also been associated with more active behavior patterns. Pursuing their search for a more objective identification of individuals with behavior pattern type A, the Friedman group has developed a twenty-item questionnaire and a voice analysis method of taped interviews which, they report, have achieved this objective. Jenkins, in a computerized analysis of the questionnaire reports an astounding 73 percent correlation with interview assessment of type-A pattern.

Bahnson has suggested another personality type for men with coronary artery disease in which passive and dependent traits rather than assertive and dominant ones are manifested. This more "passive" pattern is hypothesized as developing from unresolved attachments to mothers as opposed to fathers which is suggested for type A.

The work of Friedman and Rosenman is in some ways a refinement of that pioneered by Flanders Dunbar in the 1930s and 1940s. Based on an extensive review of the literature until that time and the intensive examination of 1600 hospital admissions, she identified personality profiles

for patients with a variety of illnesses, including coronary occlusion, hypertensive cardiovascular disease, angina, rheumatic heart disease, and arrhythmias. Her profiles included not only obsessive-compulsive personality traits, but also passive-aggressive defenses for the expression of hostility and anger, rigid middle-class social patterns, and involved symbiotic family relationships. For each of these illnesses she delineated one or more features in several areas of the individual's psychosocial field that was characteristic for the group as a whole. These early identifications have spurred other investigators toward more specific examinations using more sophisticated methodologies.

More thorough studies, such as those of Storment, have failed to confirm an overall personality type for cardiovascular illness, although accord sometimes has been reached for selected traits, such as stability of mood in patients with coronary occlusion and overcriticalness in hypertensives. Other studies continued to investigate the possible correlations between personality and cardiovascular disease. More often than not, it seems that what is considered as personality is poorly defined and refers rather to one or several specific traits. Besides this difficulty, as several critics suggest, many of the studies have been retrospective and as such are more suggestive of types of responses to coronary disease rather than of common psychological precursors. Studies have included highly selected survivors, ignoring the 30 percent who died before inclusion, as well as those with "silent" infarctions

who are rarely identified. Prospective studies, focusing on more objective measurements and larger numbers may overcome some of these deficits. The few prospective studies that have been executed have attempted to answer some of these criticisms. Lebovits et al. noted that individuals who died of coronary artery disease had higher Minnesota Multiphase Personality Inventory (MMPI) scores on several testings as compared with those who survived. Among survivors there had been a worsening of MMPI scores between the first and second examinations prior to infarction as compared to individuals who did not subsequently develop heart disease. Brozek followed 258 business and professional men between the ages of forty-five and fifty-five, over fourteen years, subsequently comparing thirty-one who developed coronary disease with 138 who did not. The former showed higher hypochondriasis scores on the MMPI, were more “aggressive” in their interests, and had higher scores on the Activity Drive Scale of the Thurstone Temperament Schedule.

Of studies that have been retrospective, Ibrahim et al. have suggested that the similarities in characteristics that they and others have identified probably are related to the reaction of patients to the disease." They studied hypertension and elevated serum cholesterol in a coronary group and compared it with two at-risk groups, noting that two-thirds of the coronary group as opposed to one-fifth of the noncoronary group showed low-level manifest hostility and elevated levels of anxiety and regression. However,

Shekelle et ah, based on cross-sectional and longitudinal observations of middle-aged men, conclude that a psychological pattern is not related to either the risk of coronary heart disease nor is its occurrence related to the loss or acquisition of psychological patterns.

Other retrospective studies have contrasted victims of cardiac disease with other populations. Bendian and Groen found patients with myocardial infarctions to be extroverts and suggested a cyclothymic personality for coronary patients. Mine et ah, found cardiac patients to show a greater degree of rational control. Their patients showed greater inhibition both in behavior as measured by standard psychological tests and in cerebral cortical functioning as measured by alpha-wave frequency, critical frequency flicker, and reaction time. Cohen and Parsons contributed a negative correlation showing that there was no difference in time perception in coronary patients as opposed to others, and hypothesized that what previous investigators had identified in this regard related to socioeconomic variables. Dreyfuss et ah, observed that victims of myocardial infarction viewed the environment as more conflict-laden, the outcome of their actions as more unclear and with less certainty of success. They felt their study supported Cleveland's and Johnson's hypothesis of weak ego boundaries based on the identification of chronic restlessness, underlying passivity, suppressed hostility, and sexual conflicts. Subsequently Dreyfuss noted that infarction frequently occurred in depressed patients. Wolff described compulsivity, repressed hostility, strong

repressive superegos, and unfulfilled oral needs for psychiatric patients with angina pectoris. Bruhn et ah, contrasted survivors with nonsurvivors noting greater depression as determined by the MMPI for the latter.

In summary of the psychosocial aspects of coronary artery disease during the past decade on the basis of carefully constructed hypotheses and methods, several conceptual approaches to the study of the precursors of coronary artery disease have emerged. Paffenbarger, Thomas, and the Framingham group have noted the association of such risk factors as smoking, hypertension, cholesterol levels, early parental death, and activity patterns with the subsequent development of coronary artery disease.

Hinkle has produced striking evidence suggesting that higher education at the time of employment is the signal variable correlating with a lower incidence of coronary artery disease. He suggests that this may be related to social and economic factors. Shekelle et al. have introduced the intriguing observation that social incongruity is related to increasing risk for coronary artery disease. Friedman, Rosenman, and their associates have repeatedly identified the type-A behavior pattern as the single most frequent variable correlating with the development of coronary artery disease. Jenkins through a computerized analysis of interview and questionnaire data has verified this. The social, behavioral, and physiological interrelationships remain to be elucidated. To what extent these are mutually independent or dependent,

genetically or epigenetically determined or cumulative remain for present and future investigators to unravel.

Stress and Illness Onset Precursors

In recent years, attention of investigators has turned increasingly to the environmental situation in which cardiovascular disease is first experienced. The stress researchers, while not ignoring the importance of genetic and previous behavior patterns, identify catastrophic events occurring in temporal proximity to the first symptoms and signs of cardiac disease. Harold Wolff, a father of modern stress research, in a number of carefully designed and executed studies demonstrated a relationship between stressful situations and such physical factors as circulatory efficiency, faulty exercise tolerance, hemodynamic response, cardiac arrhythmias, renal blood flow, electrocardiogram, and blood-pressure changes in patients with and without structural heart disease. He identified that stress occurring concurrently with physical activity delayed return of cardiovascular factors to the resting state following cessation of activity. Noting that individuals responded cardiovascularly to stressful situations either hyper- or hypodynamically, he offered as an explanation that the type of response depended on the symbolic significance (often learned) of the stress to the perceiver. Only in this way and for the individual was stress specific for a specific cardiovascular response. Fisher noted that patients with cardiovascular disease frequently presented a

history of working excessively under self-imposed and environmental pressure, and reported a gradual increase in the number and intensity of stressful situations prior to the onset of manifest heart disease. Van der Valk and Groen emphasized the occurrence of myocardial infarction in a work situation as a result of interpersonal conflict precipitating an exaggeration of aggressive behavior. Liljefors and Rahe, in a study of identical twins correlated life dissatisfactions as the single most consistent factor with the severity of coronary heart disease, as distinguished from smoking, obesity, hypercholesterolemia, the medical history and the physical examination. Raab reviewing 305 studies relating stress factors to coronary artery disease suggested that emotional and sensory stresses resulted in central nervous system arousal of the pituitary-adrenal and sympathoadrenomedullary systems resulting in the overproduction of adrenocortical steroids and sympathomimetic catecholamines leading to a depletion of myocardial potassium, elevation of blood pressure, and local myocardial hypoxia. He included fear, anxiety, anger, frustration, and optical, accoustical, and thermal percepts among precipitating stimuli. Wolf, studying sudden death from myocardial infarction and cardiac arrhythmias attributed these to undampened autonomic discharges in response to either afferent information from below or impulses resulting from integrative processes in the brain involved in adaptation to stressful life experiences or both. He suggested that triggering stimuli were effective in situations of weary dissatisfaction,

frustration, feelings of abandonment and dejection, especially at times when emotional reactions were not forthcoming from others. Engel emphasized both inhibitory and excitatory parasympathetic responses in association with stressful situations as leading to sudden death, the determinants of the response depending upon individual psychobiologic perception and reaction to stress. Paul identified the epidemiologic and prodromal causes of sudden death relating these to arrhythmias and abnormal free fatty acid metabolism. Rees and Lutkins found a six-fold increase over the expected mortality in deaths from myocardial infarction in London widowers within a six-month period following the death of their spouses. Critics such as Horvath view present research as imprecise because of the failure to carefully identify and measure stress. Mine sees coronary artery disease as a disease of civilization, and as a consequence of an attempt at intellectual control over feeling and subsequent behavior conditioned by a social environment that disallows emotional response to stress, resulting in an arousal of the autonomic nervous system. Werko suggests that attention to the changing social structure in the community may be of the greatest importance in the prevention of ischemic heart disease. These speculations lead into metaphysical contemplations regarding the relationship of the disease and civilizations which go beyond our present knowledge and our methods of research.

In summary, the situation in which myocardial infarction, physiological

decompensation, or sudden death occurs has been the subject of several investigations. The illness onset situation, whether of the initial process or a recurrence, is seen as a stressful one leading to psychological and physiological changes. Stressful situations are frequently associated with loss and bereavement which in the vulnerable or sensitized individual may lead to psychological and physiological decompensation. The particular stress eliciting a reaction may be nonspecific and is dependent on other factors predilecting the individual to a vulnerable physiological state. The reaction of individuals are variable, both psychologically and physiologically. Since different individuals may react hyper- or hypodynamically to the same stressful situation, it is not possible to universally associate specific stresses with specific patterns of response. Individual variation of response depends on how the individual perceives the stress symbolically, and on innate or learned patterns of physiological response associated with that percept.

Reactions to Coronary Artery Disease

Perhaps of more immediate application and reward in the field of the psychological aspects of cardiac disease are the investigations of the individual's reactions to the symptoms, signs, and diagnosis of cardiovascular disease, for it is at these points that specific and often life-threatening emotions and the defenses against these may be precipitated. Examples are the studies of Hackett and Cassem and Olin, who identified denial in subjects

with chest pain at the time of myocardial infarctions as causing delay in seeking medical attention. Their subjects, many of whom were sophisticated in the various meanings of chest pain, attributed their discomfort to more benign conditions than myocardial infarction. Although some subjects had previous infarctions, these too tended to use the expression, “I thought it couldn’t happen to me,” in describing their reaction to substernal pain. If this occurs in survivors and repeat victims, the question may be asked how often this or a similar response occurs in subjects who die before seeking medical help. If this pattern occurs in as many individuals as some epidemiologists believe, then a study of this reaction may be a crucial consideration for psychiatrists and other workers in preventive cardiology. Although most subjects studied have been observed to use denial at one or more points in their reaction to cardiac disease, observers have noted that, whereas in the early phase of illness it is simply a denial of the symptoms as a way of contending with anxiety over the possibility of death, this early denial is a fragile and brittle defense which subsequently is replaced by more characterological mechanisms in which the denial of illness and of its significance may become manifest by inappropriate behavior, also threatening to the recovery of the individual. Arlow has noted that the manifestation of anxiety in anginal patients depends upon the defenses the individual erects to cope with this anxiety which, in turn, are determined by the individual’s previous experience as well as his current emotional state. He

sees overwhelming panic leading to the use of repression and denial. Ideation encountered in these patients includes fear of dying, fantasied loss of love, abandonment, and at times aggressive and homosexual impulses as means of coping with this fear. Croog et ah, identified greater denial in postinfarction patients of Jewish or Italian background than in those patients of British or Irish descent. They demonstrated the persistence of denial in 20 percent of their subjects over a year's time. Bakker, contrasting individuals with arteriosclerotic heart disease with anginal patients, identified more emotional lability, tenseness, conflict, and compulsivity in the latter. Cleveland and Johnson compared postcoronary with presurgical patients, noting chronic restlessness, underlying passivity, and suppressed hostility in the former. Rosen and Bibring related behavioral reaction to myocardial infarction to age and social status. Depression and scrupulous cooperation were greater in older patients, whereas cheerfulness and active defiance were seen in younger ones. Anxiety was more prevalent in white-collar workers, while casualness prevailed in blue-collar workers. Croog and Levine, studying reactions of patients between the age of thirty and sixty to myocardial infarction, found that higher-status individuals showed a greater awareness of emotional stress as an etiological factor than lower-status patients who were less inclined to talk about their reaction to illness. Rodda et al., also identified greater anxiety in younger patients, and depression in older patients. Druss and Kornfeld following survivors of cardiac arrest described

the defense mechanisms invoked to control anxiety precipitated by this experience. Subjects reported violent and frightening dreams, and identified various theories and explanations in order to integrate the experience of having been dead and reborn. Residual problems included insomnia, irritability, and restriction of activities beyond what was medically appropriate.

Treatment and Management

The recognition of chronic anxiety and persistent depressive states in patients with coronary artery disease has led a number of investigators toward examining models of therapeutic intervention. Pelser emphasizes that many patients experience myocardial infarction at a time when they are already under emotional strain and that in the course of treatment they should be given permission to ventilate and discuss their frustration about the broader emotional field. Noting that these patients frequently manifest behavior pattern type A and do poorly in passive situations, he stresses the need for the physician to seek the active cooperation of the patient in his recovery. He suggests that the patient who has usually repressed hostile feelings be encouraged to complain and make demands on his environment, now that he is ill as a means of giving expression to his pent-up frustrations. Bilodeau and Hackett investigated the reaction of postmyocardial infarction patients meeting together with a psychiatric nurse over a three-month

period. Subjects that came under discussion in this group process included: current and future states of health, effects of illness on one's life, the role of the patient and its effect on the family, the history of the illness, and medical care following discharge. Adsett and Bruhn have written about the advantages of short-term group psychotherapy for postmyocardial infarction patients and their wives. Hellerstein and Friedman finding unnecessarily limited sexual activity among patients with arteriosclerotic heart disease emphasized the need for counselling patients and their spouses about this important function. Wishnie et al., describing the anxiety and depression in infarction patients after returning home emphasized the need to prepare the patient for the weak, fearful, uncertain feelings he may experience. Among the recommendations they make to the medical team caring for these patients are: regular telephone contact during early convalescence, establishment of a program of mental and physical activity, avoidance of vague advice, prescription of drugs for sleep and of tranquilizers for anxiety, and assisting the patient in altering his lifetime habits in order to adapt to coronary disease. Walter et ah, describe the effect that arrhythmias have on patients with coronary disease, leading to symptoms of cerebral ischemia including dizziness, giddiness and syncope. These reactions may be both a cause of and a reaction to anxiety and may be allayed by working with the patient's chronic anxiety. Patients with symptoms of angina pectoris frequently experience this distress at times of stressful environmental situations leading

to emotional conflict. At other times, some of these patients are subject to conversion reactions imitative of their anginal disease. Conversion reactions frequently occur in patients with underlying anxiety and covert depression relating to their illness. These patients may become increasingly hypochondriacal and develop what has been called a cardiac neurosis superimposed on their cardiac disease. Psychiatric intervention in the form of relaxation techniques has been employed in these situations by Rifkin. Wincott and Caird identify two phases of concern regarding the return of cardiac patients to work. In the first phase, the individual is concerned with employment and finances. Later, after returning to work, he is concerned about increased dependence, invalidism, and performance. Williamson et al., followed seventy-four patients admitted with congestive heart failure to a coronary care unit finding that only two were asymptomatic and functioning normally after a year. Twenty-four had returned to work but were symptomatic. Another nineteen, although ambulatory, were unable to assume life activity. Seven remained bed-ridden and twenty-two had died. Concerned about the staggering morbidity and mortality, they saw this as a critical area for further research. Wells finds physicians and employers partly responsible for patient failures to return to work and sees the need to educate employers and insurance companies and for employee retraining programs. Perlman et al., contrasted 105 patients with congestive heart failure with fifty controls, finding long-standing emotional problems, difficulty in accepting illness, overt

denial, and major problems concerning living arrangements. Rosenberg found that patients with congestive heart failure showed improved function and a lower hospital-read-mission rate after participation in a group-education program.

Finally Riseman suggesting that few of the injunctions about activity, food, blood pressure, smoking, alcohol, anticoagulants, and vasodilators are proven, believes that the best course for the patient to follow is moderation in all things, gradually returning to normal activity and moderate exercise. He should reduce weight, limit intake of saturated fats, control blood pressure, and eliminate or reduce cigarette smoking. Psychotherapy may be necessary to achieve moderation for the coronary patient with type A behavior.

Conclusions

A summary of the studies that have been cited herein suggests that coronary artery disease is more likely to occur in the individual who: (x) has a family history of cardiovascular disease; (2) lives in a family or social structure in which genetic determination and/or sociocultural values foster a particular behavior pattern; (3) lives in a physical environment in which cardiotoxic factors are present; (4) engages in an aggressive, competitive, upward-mobile culture without resolving internal conflicts about dependency, passivity, and sexuality; (5) becomes involved in nonspecific

stressful situations in which these unresolved conflicts are aggravated, leading to a psycho-biological decompensation elaborated through the stimulation of the hypothalamus from above and below with an excitation of both autonomic and adrenal cortical activity; and (6) develops, in the face of morphological change and physical decompensation, behavioral patterns that are predicted by the direct effect of those changes on the central nervous system and the psychological defenses erected to contend with vulnerability and chronic illness. The elaboration and identification of all of these factors in a particular patient will lead the physician to an identification of those for which help can be sought, as well as to a greater awareness of and empathy for the affected individual.

A review of the psychological aspects of cardiovascular disease as presented above commences with the limited genetic and environmental factors that are known. Genetic factors may include either a single genetic substrata that determines predisposition to both a behavior pattern such as Type A and coronary artery disease, or the two independent factors closely linked may be inherited separately but usually together. On the other hand, the association between cardiovascular disease and particular psychological patterns may result from the occurrence of heart disease such as rheumatic fever at a vulnerable time in development, resulting in psychological fixation at that stage and subsequent distorted development. In the case of the individual with congenital heart disease, the structuring of personality and

behavior patterns may also result from the effects of the disease on the intellectual development and/or the limitations imposed by parents and society on the individual with heart disease. Other patterns are identified in terms of the reactions of individuals to acquired heart disease, their emotional responses, and the defenses erected to contain these. An interesting theoretical consideration is that the early association of cardiovascular response to environmental events with repetition becomes conditioned and reinforced. In time the environmental stimulus triggering the cardiovascular response may be replaced and internalized as a symbolic stimulus which no longer needs the same external event for activation. With constant repetition and under the appropriate environmental milieu (internal or external) secondary changes such as atherosclerosis and cardiomyopathies develop. An extensive review of the literature suggests that the relationship is not a linear and unidirectional one between two variables but is more likely a cyclical process including multiple variables that may be stimulated at various points in the cycle. Hence, personality variables may lead to behavior which is cardiotoxic, but cardiovascular disease may also lead to behavior or reactions that are neurotogenic. For either of these reactions to take place, the simultaneous occurrence of other variables including genetic, psychosocial and environmental may need to be present. For the individual patient, an examination of the individual's psychological and physical development, the psychosocial field in which the illness is exacerbated or

precipitated, and the reaction of the patient, his family, and society to his illness is necessary in order to assist the patient and his family in the very arduous and circuitous road to maximum rehabilitation.

Psychophysiological and Psychodynamic Problems of the Patient with Structural Heart Disease[2]

Morton F. Reiser and Hyman Bakst

Congestive Heart Failure

Physiological Considerations

The basic physiological problems involved in structural heart disease that leads to congestive failure can be understood as one of supply and demand. With the progressive decrease in cardiac reserve that results from the heart lesion, there ensues progressive difficulty in maintaining adequate cardiac output in response to varying functional demands.

Congestive heart failure will develop whenever myocardial capacity is inadequate to meet the metabolic demands of the body. Certain events then

occur which lead to the classical picture of congestive failure, and chief among them is the impairment of normal renal mechanisms with the resultant retention of salt and water. The ultimate responsibility for this fluid and electrolyte imbalance must be assigned to circulatory inadequacy, but the immediate and crucial mechanism is altered renal function. Consideration of congestive failure must therefore be concerned not only with disordered circulatory dynamics but with the physiological factors controlling the disposition of sodium chloride and water by the kidney.

The balance between tissue needs and the ability of the heart muscle to meet them may be disrupted by increasing the demand or by reducing the functional cardiac reserve. Infection, exertion, increase in blood volume, certain paroxysmal arrhythmias, and emotional stress are all factors which may lead to a relatively abrupt increase in the demand for cardiac work. Diminution in coronary blood supply, inflammation (myocarditis, myocardosis), arrhythmias which reduce efficiency of cardiac function and emotional stress are factors which may lead to relatively rapid decrease in the heart's capacity to perform work. Increased demand and decreased capacity may occur in combination, and as reserve decreases with time and advancing disease, progressively smaller loads determine the limits of compensation.

There is a direct relationship between cardiac output and effective

renal-plasma flow; diminished cardiac output lowers the glomerular filtration rate, thereby producing a decrease in salt and water excretion. This is not the sole regulating mechanism however, and it has been established that the renal tubule may operate independently of the glomerulus in this respect. The renal tubule is the second discrete regulator of sodium chloride and water balance. For purposes of simplification, the glomerulus may be considered to be affected primarily by hemodynamic changes. Tubular function, on the other hand, is modified chiefly by humoral agents.

The humoral agents which affect tubular function include the antidiuretic hormone (ADH) of the neurohypophysis, which promotes water reabsorption, and the adrenal corticosteroids, which promote sodium retention. Of the latter, the most potent is aldosterone, but other steroids (hydrocortisone, corticosterone) also exert an appreciable effect. Norepinephrine can also cause marked change in sodium excretion. Both adrenal activity and altered circulatory dynamics are necessary for the development of edema, the prime feature of congestive failure. There are many factors which evoke increased aldosterone activity in congestive failure, including dietary restriction of sodium, impaired hormone degradation due to hepatic congestion, and elevated serum potassium levels. In addition, those adrenal steroids which are under ACTH (adrenocorticotrophic hormone) control all have sodium-retaining activity and can, at times, tip the balance in the direction of failure. The role of emotional stress in increasing adrenal

cortical activity is well known and will be referred to more fully in the following section when the emotional factors in congestive failure are discussed.

In attempting to clarify the mechanisms underlying the clinical phenomena which concern us, it is pertinent to consider the ways in which psychological stress may affect circulatory equilibrium, either by increasing current demand or by decreasing available supply, and/or by altering renal function.

Psychophysiological Changes Leading to Increased Cardiac Work Demand

It has been repeatedly demonstrated that "emotional stress" may be accompanied by measurable changes in arterial blood pressure, heart rate, stroke volume, cardiac output, and peripheral resistance. Perhaps the most carefully and extensively documented study from a physiological point of view is that of Hickam and co-workers who utilized a spontaneous, nonspecific stress situation—an important academic exam—in order to demonstrate differences in measurements reflecting circulatory dynamics obtained during "emotional tension" from measurements obtained during relative relaxation. The subjects were twenty-three healthy medical students. Each student was examined just before the critical exam and then again a day or two later, after having been informed that he had passed. The average

cardiac index (volume output of the heart l./min per $m.^2$ body-surface area) before the exam was 2 l./min. per $m.^2$ greater than that measured during relative relaxation. When this figure was converted to "work load," it corresponded to a load which would be demanded by increasing oxygen consumption by an amount equal to the basal metabolism.

In Hickam's work, as well as in that of other authors cited in the footnote on this page, the meaning of the psychological stress and the nature of the reaction to it were not specifically studied in the individual subjects. Hickam noted that the pattern of mobilization varied in his subjects, and described three patterns. For the largest part of the group, anxiety was accompanied by an increase in cardiac index, decrease in peripheral resistance, and relatively small rise in mean arterial pressure. In a smaller second group, the "anxious state" was associated with a slight to moderate rise in peripheral resistance, with a rise in mean blood pressure and no change or a slight decrease in the cardiac index. In three subjects there were rises in cardiac index but large moment-to-moment fluctuations in stroke volume and heart rate.

Much research has been done in an effort to determine whether specific differences in pattern of circulatory response may be related to specific differences in the concomitant emotion involved. The investigative group headed by H. Wolff at Cornell, through the use of structured stimuli

(introduction of conflictual topics during interview), have described relationships between different directly observed (and subjectively reported) affects and different patterns of circulatory mobilization. Funkenstein et al., working with groups of healthy subjects under a specified stressful task, have described three patterns of emotional response which they designate: "anger-in," "anger-out," and "anxiety." On the basis of ballistocardiographic, heart-rate, and blood-pressure recordings taken simultaneously, they reported that subjects showing the "anger-out" pattern developed circulatory changes similar to changes produced by the administration of noradrenalin. (This resembles the second pattern described by Hickarn, see above.) Subjects showing "anxiety" and "anger-in" reactions demonstrated changes similar to those that would be produced by injection of adrenalin (resembling the first pattern described by Hickarn). Ax and Schachter, working on subjects who were exposed to laboratory situations deliberately staged to evoke either anxiety or hostility, reported differences in pattern of circulatory changes similar to those described by Funkenstein.

The implication of this is that outwardly displayed anger is accompanied by a release of norepinephrine, whereas anxiety and anger directed inward are accompanied by the release of epinephrine. It should be noted that these implications have been drawn by indirect inference from measurement of circulatory functions, and the studies did not include assays of the hormone levels in the blood. The inferences drawn are also open to

criticism, since they were based upon quantitative amplitude measurements of ballistocardiographic tracings obtained by the use of direct-body pickup instruments which cannot be satisfactorily calibrated. The issue may be more complicated than this, since Lacey and coworkers have advanced definite evidence to show that individual differences in pattern of response may be largely reflections of constitutional differences, and only partly reflect specific connections between specific affects and particular patterns of response. Reiser, Weiner, and Thaler, in recording circulatory functions during projective psychological testing, observed the first two patterns reported by Hickarn, as well as an intermediate group which, like Hickam's, seemed too variable from moment to moment for adequate qualitative classification. In all subjects, brisk responses (of the same magnitude as those reported by Hickarn and others) occurred in association with little directly observable or subjectively reportable evidence of affect. The amount of affect which could be identified in this way was not sufficient for classification. Differential patterning of the circulatory responses appeared to be related more to differential attitudes toward the examiner, but the experiment did not allow for adequate exploration of the unconscious aspects of this relationship. Although the question of specific relationships between affects and physiological patterns of circulatory response is left open, these studies singly and collectively demonstrate that emotion is accompanied by circulatory changes which may greatly increase the amount of work required of the

heart. Stevenson et al., have demonstrated that the circulation recovers from the effects of exercise slowly and inefficiently during states of emotional tension, thus prolonging the strain upon the heart.

Most of the studies referred to above deal with changes in healthy subjects whose circulatory systems were presumably normal. The studies of Hickarn, Wolff, and others were extended to patients with valvular disease and limited cardiac reserve, with similar results. Striking is Hickam's demonstration in a patient with severely limited cardiac reserve that the effects of exercise and anxiety were similar and were in the direction of developing congestive failure. Cardiac index and pulmonary arterial pressure were determined by cardiac catheterization. With anxiety as well as with exercise, there was a failure of the cardiac index to rise, accompanied by an increase in pulmonary arterial pressure.

Psychophysiological Changes Leading to Decreased Myocardial Capacity

Diminution in functional cardiac reserve during tension may occur as a result of interference with intrinsic cardiac mechanisms governing heart rate and rhythm. Changes in the electrocardiogram reflecting such interference with cardiac mechanisms have been repeatedly demonstrated by numerous workers, including Katz et al., Mainzer and Krause, and Wendkos. This literature has been reviewed by Weiss.

Psychophysiological Changes Altering Renal Function

There have been only a few studies which bear directly on the role of emotional factors as they affect renal function. Diuresis has been reported in both animals and man following emotional stress, and investigations have been conducted on the effect of specific emotions on fluid and electrolyte balance. Schottstaedt and his co-workers have reported a series of such studies, and indicated a direct correlation of certain emotional response patterns with specific types of alteration of water and sodium excretion. They found that feelings of anger, uneasiness, and apprehension produced increased rates of water and sodium excretion, whereas feelings of depression were associated with decreased rates.

Confirmation of these findings by other investigators has not been reported and further research on these psychophysiological relationships is needed. Other evidence bears directly on the relationship between emotions and adrenal cortical activity and between adrenal cortical activity and renal tubular function. Thus, by inferential reasoning, one may hypothesize a sequential psycho-adreno-renal pathway as an important factor in the clinical manifestations of congestive failure.

Clinical Observations

In view of the psychophysiological findings summarized above, it is not

surprising to find that stressful events often precede the development of episodes of congestive failure in patients with established cardiac disease and limited reserve. This expectation can be affirmed readily on the medical wards of any hospital. Chambers and Reiser interviewed twenty-five consecutive patients who were admitted to the wards of the Cincinnati General Hospital because of congestive heart failure. An acute emotionally stressful experience had immediately preceded the development of congestive failure in 76 percent. In each instance these events seemed to have highly specific meaning for the patient in relation to his previous life experiences and conflicts, and in most they were superimposed upon a chronic state of sustained emotional tension. An important aspect of these findings lies in the fact that most of these patients had been through similar conflictual crises previously without having developed congestive heart failure, that is, similarly stressful experiences occurring before the critical limitation of cardiac reserve had developed, had not resulted in clinical disturbance of the patients' circulatory equilibrium. It was only after the underlying progressive heart disease had resulted in serious loss of cardiac reserve that the stressful events assumed clinical importance in respect to circulation. All of the patients in this series were seriously ill and exhibited advanced forms of heart disease and serious degrees of cardiac decompensation. They were the type of patient in whom the extent of underlying cardiac pathology might so impress the physician that he might

well not feel it necessary to search for a specific precipitating factor. It is important to recognize that the extent of the underlying heart damage does not ordinarily account for the nature of the forces immediately responsible for the abrupt onset or worsening of congestive failure. In the' same study it was noted that marked improvement in clinical status coincided with providing the patient an opportunity to share and discuss his difficult life with the physician. It was further observed that a continuing supportive relationship with the physician aided in avoiding further unresolved emotional crises and stabilized the clinical course to a great extent (without, of course, effecting any change in the extent of the underlying heart damage).

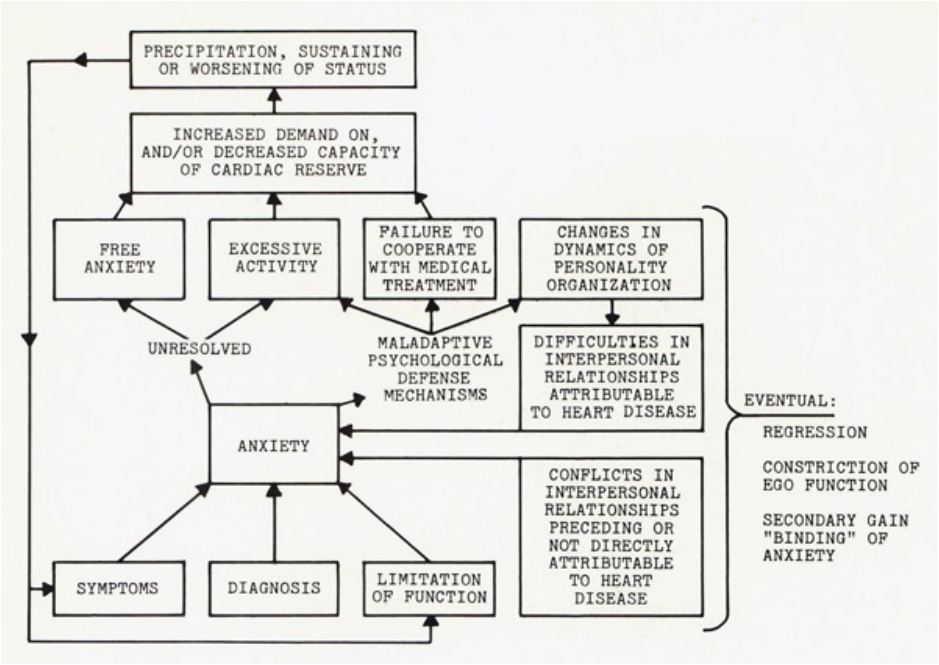
In summary, the tenuous balance between work load and cardiac reserve in patients with structural heart disease and diminished cardiac reserve may be seriously disturbed by the various circulatory responses that accompany psychological stress. In this fashion, serious episodes of congestive heart failure may be precipitated and sustained by emotionally stressful situations.

Somatopsychic Problems

In a discussion of the somatopsychic problems in patients with structural heart disease, it is useful to identify those factors intrinsic to cardiac disease which may operate as stressful agents in the psychological

sphere, and thus demand attempts at adjustment on the part of the patient. The clinical effects of each of them stem from the fact that they act as sources of anxiety. The end results may come about in two ways, either as the result of untoward effects of free anxiety and other affects upon the tenuous circulatory balance, or as the result of indirect consequences of anxiety, namely behavior which stems from maladaptive use of ego defenses against anxiety. These maladaptive behavioral phenomena, in turn, may complicate or aggravate the circulatory problem. They may lead to behavior which interferes with the patient's ability to utilize a prescribed medical regimen, for example, refusal to take digitalis. They may also be reflected in more general aspects of the patient's personality adjustment and lead to psychiatric problems (e.g., depression) which may not immediately affect circulation but may require therapeutic attention in their own right. The complexity of these direct and indirect consequences, and the manner in which they may in themselves lead to mobilization of additional anxiety (thus completing feedback cycles), is schematically illustrated in Figure 26-1.

Figure 26-1.



Psychophysiological relationships in patients with structural heart disease.

The psychological burden imposed by the onset and/or diagnosis of heart disease may stem from any or all of three general sources. The first source is constituted by the symptoms themselves. The abrupt onset of sensations, such as breathlessness, severe precordial pain, palpitation, dizziness, etc., is anxiety provoking. The initial anxiety generated at the onset of an acute episode may impose considerable additional burden upon the already compromised circulation.

The second source is the threat inherent in the diagnosis of heart disease. Any illness may cause anxiety because of actual or threatened damage to bodily integrity. In the case of the heart anxiety is exquisitely exaggerated. The reasons for this are general and universal. The central indispensable role of the heart in maintaining life provides an appropriate background for the use of its mental representation as a symbolic object of awesome unconscious fears. Ample reinforcement comes from folklore, symbolic language conventions, and a vast popular literature. It is probable that the diagnosis of heart disease activates fears of sudden, unexpected, and catastrophic death. The danger implied by the diagnosis is not to be minimized here, but it should be pointed out that fears may exaggerate and amplify it out of proportion. For example, the unconscious threat may be no less intense to the patient who is informed of the discovery of a functional cardiac murmur than it is to the patient confronted by a diagnosis of serious advanced rheumatic heart disease. In addition to these fears stemming from the diagnosis, there may be specific additional factors causing conflict. For example, a patient who has had a highly charged ambivalent relationship with a relative or close friend who died of heart disease may have unresolved problems of identification and guilt.

The third source of anxiety stems from the fact that the patient experiences (or can anticipate) a real limitation of his physical capacity, and knows that this will be progressive. The adaptive task imposed upon the

patient cannot be underestimated. Successful or ideal adjustment necessitates realistic acceptance of the loss and the attendant limitations which it imposes. It also necessitates rearrangement of living patterns which take these limitations into account and at the same time make maximal utilization of residual capacities. Many factors influence the degree to which the patient succeeds in meeting this challenge. The most important are: (1) the severity of the specific emotional impact of heart disease; (2) the strength of his personality; (3) reactions and attitudes of medical personnel, particularly his doctor; and (4) the reactions of people close to him. The psychological trauma inherent in the development of a cardiac disorder may severely aggravate a preexistent psychiatric problem. In some instances it serves as a precipitant for the development of major psychiatric difficulties in a previously satisfactorily integrated personality.

There are a number of ways in which the handling of anxiety may lead to unsatisfactory responses. Inadequately resolved anxiety may worsen the medical condition, as described above. In addition, psychological mechanisms, which ordinarily have the function of defending against anxiety, may be inappropriately and maladaptively mobilized in the patients attempt to defend against the threat. For example, specific ego defenses such as denial (for example, of illness) and reaction-formation (for example, against dependent wishes) may lead to open, unrealistic, and rebellious unwillingness to adhere to a prescribed medical regimen. This is a problem

frequently encountered in middle-aged men with coronary disease, and such behavior may unwittingly be self-destructive. So far as it contributes to progression and aggravation of symptoms and further actual constriction of the patient's physical capacity, it creates new anxiety, and in this indirect way another type of vicious cycle is established.

Disturbances in the sphere of behavior may not be restricted to issues centering on the physical disorder and its care. Profound changes may develop in the basic functional organization of the personality. Extensive reliance upon defenses, such as projection and displacement, may lead to drastic changes in the patient's view of the world and his reactions to specific people. Unconsciously determined changes in significant and important relationships may result—for example, dissolution of business associations, divorce, etc. These too may represent fresh sources of tension and conflict which lead to still another type of feedback cycle. Even without this, symptomatic behavior of this magnitude represents major psychopathological development and demands therapeutic attention in its own right.

As the situation progresses, more far-reaching long-term changes may become evident. As in any major illness, strong regressive tendencies develop, and when these are added to and combined with the kinds of developments described above, a process is instituted which may eventuate

in serious constriction of all aspects of ego-function in general, and, in particular, in restriction of the defensive operations of the ego to relatively few mechanisms that are for the most part maladaptively utilized. The cardiac status becomes part of the self-image, and the personality becomes constricted, rigid, brittle, and fragile. The cardiac status may become a nuclear part of the patient's style of conducting interpersonal relationships, and this is most often manifested by behavior which exploits the physical condition in the service of secondary gains which may acquire considerable value.

One additional mechanism should be mentioned, which can be described as a form of "binding of anxiety." Whenever serious physical disease (or a physical condition which can be treated as "serious") develops during a period when the patient is grappling with a serious unconscious psychological conflict, the physical disease may be seized upon as a way of resolving the conflict. For example, the illness may provide a way of avoiding the issue by precluding the conflictual activity and may thus reduce the importance of the conflict to a state where it is of academic interest only. Two typical and frequently seen examples of this mechanism can be cited. The first is the example of the patient in early adolescence who has not yet reached a satisfactory resolution of problems centering on issues of sexuality and independence; chronic invalidism for such a patient may provide a very convenient way out. The second example is that of the overtly aggressive and

ambitious man who harbors unresolved problems about success. Here again, even early manifestations of cardiac disease may offer a face-saving occasion for retrenchment and retreat from vocational growth. In other words, the status of illness may acquire a powerful psychic value because it offers opportunity for "acceptable" avoidance of serious conflicts that would be activated in a fuller life sphere.

Essential Hypertension

Introduction

The concept of essential hypertension remains variable and imprecise despite increasingly sophisticated techniques for correlating physiological and biochemical processes with elevated blood pressure. An etiological and physiological explanation for more than 90 percent of hypertension remains undeveloped.

Essential hypertension is generally identified by blood-pressure readings of greater than 140/90 mm. Hg. for which an etiology has not been identified. Its incidence is usually higher for each advancing decade. Its prevalence is greater in some geographical areas and sociocultural groups than in others. The readings themselves may be associated with progressive symptoms and signs. The former includes "top-of-head" headaches, dizziness,

ringing in the ears, and irritability. Signs include epistaxis, elevated blood-pressure readings, and retinal changes. Secondary symptoms and signs are associated with pathophysio-anatomic changes occurring in organ systems, especially the heart, kidneys, and brain.

The course of the disease may be benign or malignant. Recent statistics suggest that even in benign situations, the course is relentlessly progressive despite a slower development of secondary organ involvement. What governs the differences between a benign and a malignant course remains essentially unknown, although a recent study has suggested different renin and aldosterone patterns in patients with hypertension which seem to have prognostic value in terms of myocardial infarcts and cerebrovascular accidents. Nevertheless, we are left with a poorly defined phenomenon which undoubtedly groups together symptoms, signs, and secondary patho-physioanatomic manifestations for which future research may establish one or more precise etiological factors.

Epidemiological Considerations

Before considering the psychological aspects of essential hypertension, some attention needs to be given to epidemiological findings. Similar to coronary artery disease, epidemiological considerations are fragmentary and for the most part supply only limited impressions upon which derivative

formulations are based. The picture is further complicated by the seemingly conflicting findings often reported from the epidemiological field. Studies in the United States have demonstrated that hypertension is higher among urban than among rural dwellers, among lower than upper classes, among blacks than whites, and in men than women. It is also noted that the development of hypertension is more frequently observed and of greater severity in the rural dweller who moves to the city than in the individual who has always lived in the city.

Donaldson, studying changes in disease incidence and prevalence among rural Africans undergoing acculturation, noted that hypertension was greater in the more acculturated urban groups. Obvious correlates of acculturation are changes in life style which include food, housing, work, and interpersonal relations. The changes in disease patterns are probably more complex than the apparent associations suggest. For example, the changes observed may be related to an unmasking of a latent genetic predisposition in a population that rarely became manifest in the less sophisticated and more socially supporting tribal state where infectious disease and starvation frequently lead to early death. Other relative factors may be considered, although supporting data are lacking. Blood-pressure levels identified as falling in the hypertensive range in one geographical area and biocultural population are not necessarily equivalent to identical values for another area and group. These studies suggest that both genetic and environmental factors

are related in the pathogenesis of essential hypertension.

Psychobiological variables

The ensuing discussion examines genetic and environmental variables in terms of their interrelationships with psychological ones in individuals developing hypertension. In considering these interactions, several hypotheses are entertained: (1) the psychological and social aspects of behavior related to hypertension may be independent derivatives of the same or a different (though inherited together) genetic factor as the physiological component; (2) the psychological and physiological components may become associated during the course of development; and (3) the psychological component may be a reaction to the disease process.

Longitudinal Studies

Thomas is the most prominent among recent investigators of hypertension. For more than twenty years, she has studied prospectively the development of hypertension and associated diseases in medical students. In the course of her investigations, she has made the following correlations: (x) the proportion of students in graduating classes manifesting clinical hypertension was three times that in younger classes; the proportion showing transitory hypertension was double; (2) in the former group, 62.5 percent gave a history of parental hypertension compared with 36.0 percent

in the latter; (3) the "at-risk" groups also tended initially to manifest higher resting blood pressures, elevated cholesterol levels, and more intense reactions to stress behaviorally; (4) psychologically, she noted apparent submissiveness of the predisposed individual under the domination of a parent; and (5) the onset of hypertension occurring as an anniversary reaction or in the setting of an unrealistic marriage. She suggested that the observed hypercholesterolemia represented an inborn metabolic defect; that the inheritance of the deficit might be governed by a single locus, although modifying genes and environmental factors were important in determining clinical expression; and that the total behavioral pattern developing under stress might also reflect an inborn predisposition.

Paffenbarger and his associates have also made correlations between characteristics observed in college students and subsequent disease. Undergraduate patterns of cigarette smoking, elevated blood pressure, increased body weight, shorter body stature, early parental death, heart consciousness, and nonparticipation in varsity sports were associated with the occurrence of subarachnoid hemorrhage and occlusive stroke, pathology frequently resulting from chronic hypertension. Associated with heart consciousness and cigarette smoking, Paffenbarger noted emotional distress in terms of anxiety and irritability.

Some Biological Correlates with Behavior

Specific biological variables have been identified in patients with hypertension. Similar to some of the psychological variables discussed below, these are as likely to be secondary to the development of hypertension as they are to be precursors. Renin, angiotensin I and II, and aldosterone may also be considered in this light. Through the accumulation of data via longitudinal studies such as those cited above it may be possible for an eventual distinction to be made.

Schneider and Zangari noted an association of anxiety, tension, fear, anger, and hostility with decreased clotting time, increased viscosity, and elevated blood pressure. With feelings of depression, dejection, and of being overwhelmed, they noted prolonged clotting time, normal viscosity, and normal blood pressure. Hypertensive as opposed to normotensive subjects demonstrated decreased clotting time to the stress of the pressor test.

Testosterone and estrogen have been cited as affecting blood-pressure levels in addition to hormones of the pituitary-adrenal axis. Susceptible male mice developed marked hypertension and aggressive behavior when subjected to social stress, whereas susceptible castrated male mice under the same circumstances remained normotensive and nonaggressive. However, when the latter mice were given testosterone, blood pressures rose and aggressive behavior developed. In some lower sociocultural groups, premenopausal women tend to manifest higher blood pressure than men; the

reverse pattern prevails following menopause. Among upper sociocultural groups, the reverse pattern has been observed. These findings suggest that age, sex, and other variables are more than biological but interact with sociocultural roles and the personalities and life situations involved with these. Women who have family histories of hypertension and personal histories of toxemia of pregnancy appear more sensitive to the hypertensive effects of estrogen preparations. They also appear more likely to experience a depressive response to these preparations.

Von Eiff suggests that hereditary factors prime the pressor center of the hypothalamus to respond hyperactively to environmental stresses leading to increased blood pressure. Yamori et ah, have found lower concentrations of norepinephrine in the lower brain stem and hypothalamus of spontaneously hypertensive rats as compared to normotensive ones. This was associated with a lower concentration of L-amino acid decarboxylase, but not of tyrosine hydrogenase, suggesting that abnormal metabolism of ergotrophic hormones may be related to hypertension. Sjoerdsma has noted that monoamine oxidase inhibitors lead to a decarboxylation of alpha dopamine, resulting in what is in effect a medical sympathectomy. This is of interest, inasmuch as clinical observations have frequently suggested a correlation between depression and hypertension, and that the latter tends to improve with the treatment of the former with antidepressants. These fragmentary findings are identified in order to suggest the direction of neurophysiological research in

seeking a central mechanism affecting blood pressure. These and others have yet to be woven into an integrated formulation. The actual regulation of blood pressure is a highly complex phenomenon and, as Penaz has noted, depends also on the mechanical parts of the system such as the heart as well as central nervous control.

Psychiatric Relationships

As long ago as 1902, Alexander noted that blood pressure was frequently elevated in patients suffering from acute melancholia, as opposed to chronic melancholia or mania. Altschule corroborated this observation, finding that elevation of blood pressure was the rule in patients with involutional depression whereas patients with schizophrenic states more often showed blood pressure readings below the normal range. Readings in patients displaying manic behavior were only occasionally elevated. Vanderhoof et al., demonstrated a lower blood flow in patients with schizophrenic states as opposed to those with affective psychoses. Heine et al., studying hypertension in severely depressed patients, observed a decrease in blood pressure for the agitated patients following improvement in their mental status. However, those patients manifesting less agitation and having a history of more frequent depressive episodes were less likely to demonstrate a change in blood pressure following treatment. They suggest that chronicity of emotional stress correlates with irreversible changes in the

regulation of blood pressure.

Overview of Psychophysiological Relationships

Several reviews are first briefly identified and discussed to serve as reference for the student interested in further pursuit of this subject.

Alexander was one of the first investigators to consider hypertension as a progressive sequence of psychopathophysiological changes. Not ruling out the possibility of a constitutional instability of the vasomotor system, he observed that the specific neurotic handling of excessive and inhibited hostile impulses precipitated by a conflictual situation was associated with extreme fluctuations of the blood pressure. In time, with repetition of the conflictual episode, he suggested that these patterns tended to become fixed leading to chronic neurotic states associated with elevated blood pressure and still later to the organic consequences of this condition. Much of the work of subsequent investigators has elaborated on data that have been interpreted as supporting this hypothesis. However, Binger in 1951, reviewing more than 200 articles, suggested that no one had “hit the mark” in establishing a relationship between psychological influences in the etiology of hypertension. Despite the enormous growth of the literature in the intervening decades, it is still possible to make a similar assessment. Nevertheless, many of the variables that have been identified have assisted the clinician in approaching

and attempting to understand the patient with hypertension.

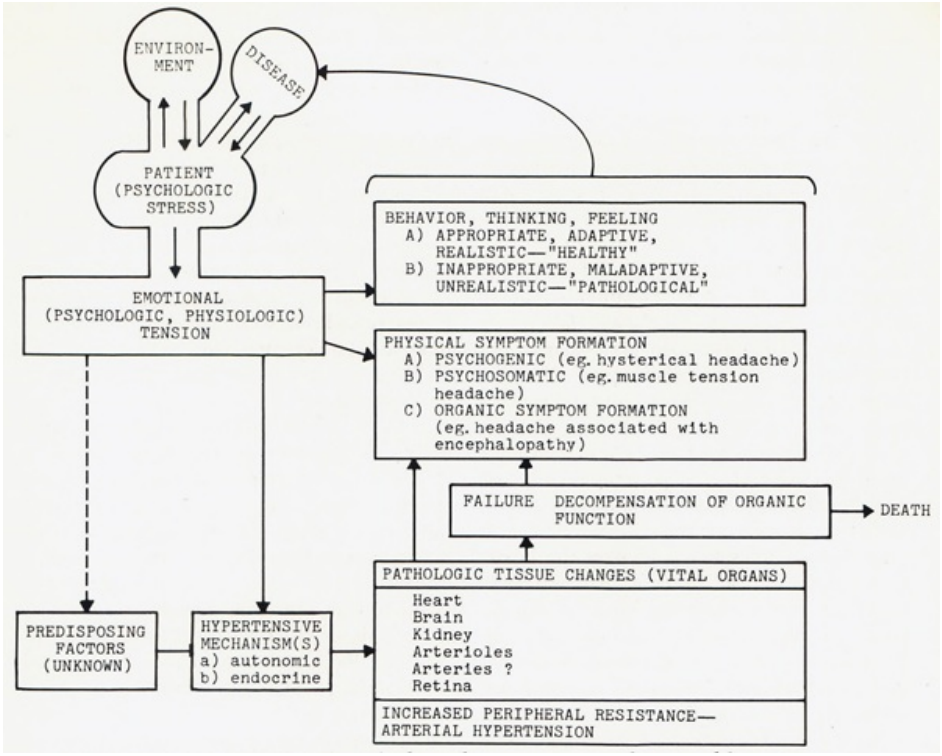
Brod conceptualizes hypertension as an intensified and extended normal hemodynamic response to an acute emotional stress, consisting of a redistribution of cardiac output, with blood shifted from the viscera and skin to the skeletal muscles, myocardium, and brain, advantageous for the performance of strenuous muscle work. The increased blood supply to the muscles is in part secondary to the release of epinephrine and is partly related to a reflex involving cholinergic fibers. This pattern is analogous to the circulatory response produced in animals by electrical stimulation of the hypothalamus, which is accompanied by apprehensive and rage behavior identified as "defense system." Brod hypothesizes that this is an old phylogenetic reaction which has been transferred from a threatening external situation to a symbolic internalized stimulus. Whereas, phylogenetically, the reaction would cease with the removal of the provoking stimulus, in the human situation the internalized symbol remains as a constant stimulus to the vascular and rage reaction, resulting in eventual pathophysiological and pathoanatomic changes. Levi suggests that emotional stress triggers sympatho-adreno-medullary and related physiological changes of relatively short duration. If repeated often enough over lengthy periods and of increasing intensity, he sees these as etiological in the development of essential hypertension.

Geiger and Scotch in 1963 reviewed the biological, epidemiological, psychological, and sociocultural factors relating to the etiology of hypertension. In concluding, these authors found ample room for further research. Essential hypertension as a pathological entity with a well-established etiological and physiochemical mechanism still required clarification. They questioned to what extent essential hypertension was related to one or more primary disease processes yet to be identified, and also whether it might not represent a variation on a norm. More research was required in establishing a hereditary basis for hypertension through the study of first-degree relatives and controls. Longitudinal studies were necessary to establish the natural history and progress of the disease. These authors saw the implication of sociocultural factors as an open question. They noted that age, sex, and other variables were more than biological, inasmuch as they served as the bases for personal interaction in a culture and family and consequently were precursors of sociocultural and personality factors, which assumed possible significance in their own right. They raised the still intriguing question whether many of the psychological variables associated with hypertension might not be more directly related to the lability of blood pressure frequently observed in the prehypertensive individual. Finally, they considered the stress factors relating to the onset of hypertension and the adaptive behavior of individuals to these and to the subsequent disease course.

Groen, following Page's Mosaic theory of essential hypertension, suggests that the reactivity of the central nervous system under the influence of genetic and environmental influences is the main causal factor in a constellation of multiple factors associated with the development of hypertension. He cites the following: (1) Hypertension is an exaggeration and intensification of normal reaction patterns of the organism; (2) It follows in the wake of repeated and prolonged conflicts; (3) It occurs in individuals predisposed to react to conflicts with key persons in certain ways, a pattern which is both genetically determined and environmentally conditioned; (4) These individuals demonstrate personality traits which include compulsivity, rigidity, sensitivity, a need for love, a fear of losing love, a tendency to dominate, a tendency toward aggression, and a tendency to inhibit the acting out of aggressive impulses; (5) Hypertension is precipitated in a conflict situation in which active aggression is inhibited; (6) Exacerbations of conflict lead to exacerbation of blood-pressure response; (7) The more severe the personality disorder and the more intense the conflict situation, the more malignant is the course of hypertension; and (8) The greater the sensitivity and the greater the reactivity associated with a greater tendency to inhibit motor discharges, the more likely will the reaction be channelled through the limbic system, the hypothalamic vasomotor center, the sympathetic nervous system, the heart, and the smooth muscles of the renal and splanchnic arterioles, leading to increased peripheral resistance. Groen sees this in terms

equivalent to a displacement phenomenon in which the organism reacts to a symbolic stress via a neurovisceral route as opposed to reacting to a physical stress via a neuromuscular route. He indicates that changes in the environmental conditions, the use of central-acting tranquilizers, and peripheral-acting blocking agents together with supportive psychotherapy have ameliorating effects on hypertension.

Figure 26-2.



Psychophysiological relationships in patients with essential hypertension.

Reiser, in reviewing his own and others' work, identifies three phases of hypertension; Phase 1; preceding the manifestation of the clinical disease; Phase 2: the onset of the disorder; and Phase 3: the continuing course of the disease once it has become established (see Figure 26-2). For each of the phases, he suggests that the underlying pathophysiological mechanisms may differ. For example, the importance and relative influence of variables, such as

sodium metabolism, emotional influences, neurogenic and hormonal mechanisms in the mediation of the psychophysiological process may change as the disease progresses. With his associates, he has recorded the difference in the labile blood-pressure responsivity of normotensives and patients labelled prehypertensive, as contrasted to the limited responsivity of blood pressure to a structured experimental interpersonal stress in patients with well-established essential hypertension. In the pre-dispositional phase, Reiser considers both genetic factors and experiential constitutional factors (deriving from the conditioning of the organism during its prenatal, perinatal, and early neonatal experience through the shaping and reinforcement of visceral functions) as contributing to the establishment of a latent but potentially pathogenic hypertensive pressor mechanism. For example, he cites the infant's crying reaction to nonspecific stress as involving a Valsalva response causing an increased intrathoracic pressure, a decreased ventricular filling, a decreased cardiac output, an increased heart rate, and an increased peripheral resistance in order to maintain the perfusion pressure of vital organs. Behavioral shaping of such a response pattern might occur through chance experiences affecting the organism in which emotions and their defenses become annealed with specific physiological patterns at "critical" phases of development. The defense pattern itself may also be learned from familial patterns of reactivity to stress. With repetition of stressful events, the relationship between the psychological and physiological reactions becomes

reinforced. On the other hand, presence of an inherent hyperreactive pressor mechanism may also directly influence the development of psychological traits, such as ego defenses, that would protect against its activation by attenuating closeness of interpersonal relationships (insulating defenses) (see also Chapter 28, Introduction). This vascular hyperreactivity in and of itself, or as a reflection of total central-nervous-system hyperreactivity, may then be associated with independently observed emotional and psychological patterns of response in individuals identified as prehypertensive or hypertensive.

In Phase 2, Reiser hypothesizes the breakdown of the critical ego-defensive systems in reaction to stress. With the failure of ego defenses, changes occur in the autonomic outflow tracts, including sympatho-adreno-medullary mechanisms and the hypothalamic anteropituitary adrenal cortical axis. Affect and regressive changes occur in a large number of ego functions including attention, perception, cognition, and intellectual functions. These also influence and are in turn influenced by autonomic and/or hormonal reactions. At this point, cyclical interactions are recognized in which not only do psychological processes influence physiological ones but the changes in the latter directly affect and compromise the former.

In Phase 3, the process developed during Phase 2 becomes fixed resulting in an individual who is different both physiologically and

psychologically from what he was in Phase 1. In this Phase entirely new patterns of behavior and reactions prevail.

Emotions

Rennie identified that blood-pressure elevation related to anxiety and depression in patients. Later Ax associated increased diastolic blood pressure with decreased heart rate, increased skin conductance, and increased muscle potential with anger. In contradistinction, fear, while associated with increases in the latter two variables as well as with respiratory rate, did not produce an elevation in blood pressure. On the basis of these observations, he related anger to a discharge of epinephrine and norepinephrine as opposed to fear which he saw as producing an epinephrine response. Funkenstein recorded similar observations, suggesting anger-out related to norepinephrine while anger-in and anxiety related to epinephrine. However, specific biochemical correlates have never been measured for these states.

Saul identified hostility as the essential component in patients with hypertension. He described this as arising from an unresolved relationship with the mother resulting in conflicts over passivity-activity, dependence-independence, and sexuality. Miller suggested that repression of hostile emotion was the core factor in hypertension. Moses observed both rage and resentment as the psychic correlates of elevated blood pressure related to

increased peripheral resistance, in distinction to blood-pressure elevations secondary to anxiety and related to increased stroke volume and heart rate without a change in peripheral resistance. Both Schachter and Van der Valk identified fear, anger, and hostility as more intense and associated with greater elevations in hypertensives as compared with normotensive controls. Kaplan et al. extended these observations by demonstrating hostile content in samples of verbal productions and hypnotic dreams of patients with hypertension. Using Rorschach factors, Brower correlated higher diastolic blood pressures in relationship to lower adjustment to reality. Graham and coworkers related elevations in blood pressure in hypertensive subjects with the attitude of having to be on guard against bodily assault. Moos and Engel, studying response specificity to stress in hypertensives vs. arthritics, demonstrated sustained elevation in blood pressure in the former and greater muscle reactivity in the latter. In addition, they showed that arthritics could adapt for blood pressure but not muscle tension where the reverse prevailed for hypertensives. Weiner et al. studying cardiovascular responses in hypertensive and peptic-ulcer patients to TAT (Thematic apperception test) cards noted that these related to the interaction of the subject and experimenter. Subjects with essential hypertension were remarkably unreactive as a group and this lack of physiological responsiveness was related to the nature of the interaction. McKegney and Williams showed that patients with hypertension, as opposed to those without, had greater

increases in blood pressure during a personal discussion phase of the interview. Williams et al. in further work suggested that blood-pressure elevation during an interview was related to the intensity of interviewer-subject interaction. Silverstone and Kissin demonstrated that patients with essential hypertension tended to be more field dependent than patients with peptic ulcer. Goldstein et al. showed that field-dependent subjects have higher GSRs (Galvanic Skin Response) at rest, and do not discriminate on a physiological level as well between conditional and other similar stimuli. Sapira et al. in showing films of "good" and "bad" doctor-patient relationships to hypertensive and normotensive subjects, found that the hypertensives tended to deny seeing any difference between the two doctors. These studies suggest that the hypertensive patient may be more vulnerable to external threats and therefore perceptually tend to screen out potentially noxious stimuli as a behavioral response protecting his hyperactive pressor system.

Personality

Dunbar pioneered the work in relating personality styles to specific illness constellations. She identified lifelong patterns of anxiety, perfectionism, compulsivity, and difficulty with authority figures as the psychological components of the individual with hypertensive disease. Gressell et al. and Saslow et al. identified obsessive-compulsive behavior and subnormal assertiveness. They also noted that this correlation prevailed

regardless of the type of hypertension. Ostfeld and Lebovits, using Rorschach and MMPI tests, also found no difference between patients with renal and essential hypertension. Noting that blood-pressure responses during periods of life stress were also similar in the two diseases they concluded that personality and attitude factors were etiologically not related to essential hypertension. On the other hand, Koster, emphasizing differences found among patients with essential hypertension, suggested that it is basically several different diseases, each with its own peculiar physiology and psychology. Davies, using the Eysenck Personality Inventory, found no correlations with neurotic traits among patients with hypertension, although he found correlations with body weight, arm circumference, body build, and a family history of cardiovascular disease.

To summarize these studies, it is suggested that individuals with hypertension cope with stresses likely to precipitate emotional feelings (anger, anxiety, sadness) with repressive and protective psychological defenses leading to behavior patterns that include altered perception, especially in the area of interpersonal relationships. When stress factors break through these defenses, aggravation and exacerbation of hypertension occurs.

Environmental Factors

Investigators have been concerned with the identification of environmental stress and its relationship to the development and/or exacerbation of hypertension. Wolf et al. studied fifty-eight patients with hypertension and reported that they met day-to-day threats and challenges with restrained aggression, simultaneously displaying a vascular reaction characterized by elevated blood pressure and vasoconstriction of both afferent and efferent renal glomerular arterioles. Even after sympathectomy, they observed that hypertensives continued to respond to threatening situations with constriction of the afferent arteriole although the efferent arteriolar reaction was abolished. Reiser et al. associated emotionally charged life situations with the course of the disease and the precipitation of malignant hypertension. Harris et al., studying "prehypertensives" (patients with labile blood-pressure responses) and matched controls, found that the former were less well-controlled, more impulsive, more egocentric, and less adaptable in stressful situations. Henry et al., using an ingenious intercommunicating box system, studied the social response of two groups of mice, differently raised, to the effect of crowding and competition. Mice isolated from weaning to maturity showed profound physical signs and pathology in addition to markedly elevated blood pressure. In addition, the deprived mice demonstrated an inability to respect each others need for territory and to control aggression. Subsequently, they observed that susceptible mice subjected to psychosocial stimulation showed increases in

catecholamine-forming enzymes. They suggest that the increase in these enzymes may be neuronally mediated and that unlike epinephrine and norepinephrine, enzyme changes may take a long time to develop. Henry and Cassel in a review article suggested that repeated arousal of the defense alarm response may be one mechanism for elevated blood pressure. In man, such arousal may occur when previous socially sanctioned patterns of behavior, to which the organism has become adapted during critical early learning periods, can no longer be used to express normal behavioral urges. Difficulties in adaptation and status ambiguity may result in years of repeated arousals of vascular, autonomic, and hormonal function due to the organism's perception of events as threatening. This may lead to progressive and irreversible disturbances.

Kasl and Cobb reported that blood-pressure levels were higher among workers during an anticipation of job loss, unemployment, and probationary reemployment than after later stabilization. Men, whose blood pressure remained higher for a longer time, were subject to greater unemployment, manifested lower ego resilience, and reported longer-lasting subjective stress. Harburg, Schull, et al. in a pilot study, identified that the proportions of persons with hypertensive levels were significantly greater in a high-stress area than in a low-stress one. The stresses identified included: ecological, personal-interpersonal (making a living, marital, early family life, neighborhood, race relations, life situations, status striving, resentment, self-

esteem), and health risks (family history of cardiovascular disease, weight, smoking, infrequent use of medical aids). Sokolow et al. studied blood pressure responses automatically recorded every thirty minutes in hypertensives who concurrently kept a log of events and completed mood checklists. The highest systolic and disastolic levels correlated with times of reported anxiety, time pressure, and alertness.

Although some workers have identified specific environmental stresses as directly affecting blood-pressure responses, a current interpretation is that hypertension develops as a consequence of the manner in which a genetically vulnerable individual perceives an environmental threat, and the defensive patterns that he gradually adopts determine the complex somatopsychosocial relationships.

Therapy

Shapiro, working in the field of hypertension for the past thirty years, has been, perhaps, the most important pioneer in therapeutic developments. Advocating supportive psychotherapy, together with the use of antihypertensive agents, he has achieved an amelioration of symptoms and a slowing of disease progression by assisting the patient in identifying and avoiding noxious stimuli and learning how to adjust to his environment and the limitations of disease. He has found therapy to be most effective when it is

transmitted in a supportive, nonthreatening, and nonauthoritative doctor-patient relationship. Wolff and Lindeman, and Sokolow and Perloff have reviewed the pharmaceutical agents used in the control of hypertension. Relaxation methods have enjoyed limited popularity from time to time. Jacobson and Raab have been proponents of these, both noting beneficial results for patients with cardiovascular disease. Gantt has advocated therapy through conditioning techniques. Most recently Miller, DiCara, and their co-workers at Rockefeller University have demonstrated effective conditioning of blood pressure in laboratory animals. More limited success has been obtained with human subjects. The relationships of these techniques to the control of hypertension by meditational experiences remains to be elucidated.

Conclusions

During the past thirty years, workers in the field have adopted a multi-factorial genesis for the ill-defined condition called “essential hypertension.” First and foremost, a primary genetic predisposition on the basis of geographic, racial, and family studies has been suggested as necessary, but not sufficient, for the development of hypertension. Environmental studies have implicated early developmental factors, especially those relating to mother-child interaction. Of considerable interest has been the observation of the alterations in perception that seem to occur in patients with hypertension

in the course of the disease, suggesting that these may represent an attempt to protect a vulnerable hyperreactive pressor mechanism. Increasing attention is presently directed at the early conditioning of autonomic responses in an attempt to explain the repeated association of emotional and psychological traits with hypertension. The emotions most often identified have been those of anxiety and hostility or anger, where expression is frequently repressed. Obsessive and compulsive personality patterns have also been identified. Depressive reactions have frequently been observed to correlate with the development and/or exacerbation of hypertension. Secondary to the development of the disease, altered physiological and behavioral patterns have been hypothesized and attributed to secondary effects of the process, especially on the heart, brain, and kidneys. Such effects may include deterioration of perceptual and cognitive functions. Stress relative to specific environmental factors has been identified as relating to the development and/or exacerbation of hypertension in genetically and psychologically vulnerable individuals. Therapeutic approaches include the combination of peripheral antihypertensive agents and psychotherapy. Several investigators have suggested the possible benefit of antidepressants when depression coexists. There is considerable excitement about the potential use of operant conditioning in modifying autonomic activity. Whether these will prove effective for all phases of the illness remains questionable.

Special Psychological Aspects of Diagnosis and Treatment

The investigation and treatment of cardiovascular disorders frequently involves specialized procedures and approaches which, in themselves, contribute to the precipitation of emotions and the erection of defenses against them. Catheterization, implantation of a pacemaker, intensive care units, and cardiac surgery are among these.

Cardiac Catheterization

Greene et al. have observed that patients undergoing cardiac catheterization exhibit four behavioral patterns: (1) anxious-engaged; (2) anxious not-engaged; (3) depressed; and (4) calm. All of these conditions showed elevated free fatty acids. Cortisol was elevated in both anxious groups, whereas growth hormone was elevated only in the anxious not-engaged group. Neither the depressed nor the calm group demonstrated elevations in cortisol or growth hormone. A follow-up study of twenty-two patients indicated significantly greater mortality among the anxious not-engaged and depressed groups. These observations indicate the stress that catheterization has for patients and how reaction patterns may be characterized by both psychological and physiological measures. They also suggest the possible prognostic value of the identification of patients' reactions to catheterization in terms of subsequent survival.

Pacemakers

Several investigators have studied reactions of patients requiring the implantation of cardiac pacemakers (see references 17, 39, 47, 77, and 225). Noting the initial anxieties of patients relative to the underlying cardiac disease and arrhythmias, they have delineated the concerns of these patients about relying on an artificial mechanical instrument, its unpleasant side effects, the possibility that batteries run out, and possible complications resulting from implantation. Blacher and Basch have identified three phases in the acceptance of pacemakers by patients: (1) the preoperative, characterized by concern with life and death, confrontation with the mystique of medical technology, fear of dependence on an artificial device that could fail, guilt, and pessimism; (2) the immediate posthospital phase characterized by depression; and (3) a later phase in which there has been acceptance of the pacemaker and the pursuance of normal activities, control and mastery of feelings, and preoccupation with physical sensations, fantasies, and denial. Crisp and Stonehill, comparing patients with external and internal pacemakers, noted that the former exhibited greater distress, and suggested that patients with implanted pacemakers were able to make greater use of denial as a defense mechanism in coping with an incurable disease.

The Intensive Care Unit (ICU)

As hospitals are absorbing the technological advances that applied scientific research and methodology brought to medicine, specialized units have been established to cope with acute and specific problems. These intensive care units (ICU) and coronary care units (CCU) have evolved from hospital wards or recovery rooms into highly complex and specially constructed acute emergency units, requiring skilled nursing and medical technicians to operate the monitors, defibrillators, respiratory and suction apparatuses, and hypothermia units. In many ways, these units have become the symbol of the new frontier in medicine, its technological coming of age. As such they present a new unknown for the patient, his family, and the medical staff. Simultaneous with the development of these units, the hospital staff has noted an increasing incidence of behavioral disturbances among patients admitted to them, a phenomenon that Nahum has aptly identified as one of the "new diseases of medical progress." Consequently, the ICUs and CCUs have become foci of interest for the behavioral scientist in observing and identifying possible explanations for these syndromes that are estimated to occur 40-60 percent of the time. Kornfeld has developed four categories for the behavior observed in these units:

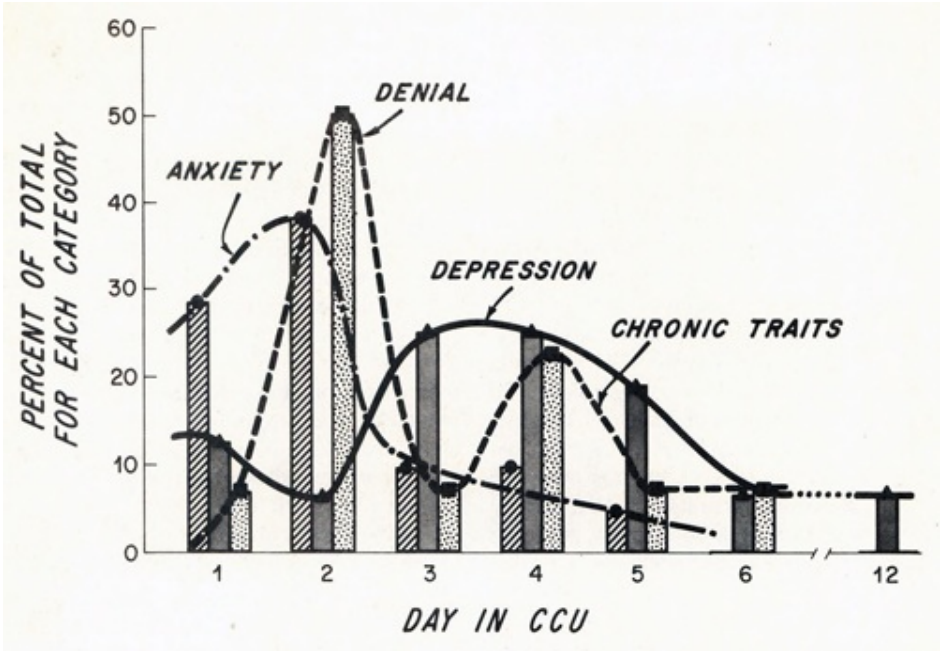
1. **Behavioral reactions** associated with the medical and surgical illness and/or arising from metabolic, circulatory, or toxic factors.

Hackett and his group, who have compiled extensive observations of

patients in CCUs, emphasize the psychological reactions to illness of the patients admitted to the CCU.33, 34,82,83 Noting that one-third of patients admitted to CCUs were referred for psychiatric consultation, Cassem and Hackett classified the reactions as anxiety, depression, and behavior disorder (see Figure 26-3). Anxiety was related to impending death or death heralds of pain, breathlessness, weakness, and new complications. Anxiety was most manifest in the first two CCU days. Depression was seen as representing injuries to the self-esteem and was observed on the third to fourth CCU day, whereas behavioral disorders had a bimodal distribution during the whole CCU period, with the primitive defense of denial most present on the second day and more sophisticated defenses, appropriate to the patient's personality style, emerging after the fourth day. The defensive behavior described included denial of illness, inappropriate euphoric or sexual responses, and projection of hostile dependent conflicts. These observations raise interesting questions about the protective role of denial. In the days following the catastrophic onset, denial of anxiety would seem to serve a protective function for the patient. Later, as his physiological course has stabilized, denial of illness may keep him from accepting and conforming to medical and rehabilitative routines. Cassem and Hackett specify psychiatric intervention in the CCU as including medication to diminish anxiety, explanatory clarification, environmental manipulations, bolstering of optimism, elaborating on the patient's anticipations, confrontation, and hypnosis. That

these techniques may be of value is proved by their finding of three times less mortality in the referred group as compared with nonreferred CCU groups.

Figure 26-3.



Psychological responses in a coronary care unit.

Organic brain syndromes, usually acute, may be associated with the cardiac dysfunction and present with symptoms and signs of impairment in the cognitive functions. These may also result from drugs administered to the patient. Occasionally withdrawal states from alcohol, barbiturates, or other drugs are observed three to five days following admission of a patient to the

ICU.

2. **Psychiatric reactions** to the unique and unfamiliar environment of the ICU.

McKegney has studied the emotional reaction of the patient to acute and catastrophic illness in the ICU setting. Identifying the initial anxiety and subsequent depression experienced by these patients, he stressed not only deficits in the physical environment, but also emphasized problems relating to the medical personnel, and the interactions between these and the patient and his family. Crucial for the patient's adjustment in the ICU is the relationship established with the medical and nursing attendants and the acceptance by the relatives of the ICU environment and the patient's condition.

Not least among the hazards of the ICU environment are emergency situations and their associated procedures. Arrhythmias are not uncommon and often demand dramatic intervention of cardioversion either by drugs or electrical defibrillation. For the patient, this means additional medications with their potential untoward effects and/or the preparation for light anesthesia and electrical shock. At least some of the arrhythmias developing in ICUs are directly associated with high-anxiety states, suggesting that on the basis of a possible causal relationship, attention to the symptoms of anxiety

may be equal in importance to attention to the arrhythmia.

Margolis, in studying psychotic reactions in patients in ICUs, emphasized the lack of privacy at a time when many desired privacy most. For these patients, he noted a diminution of psychotic symptoms on transfer to private rooms. Studies of patients witnessing deaths of other patients in the ICU by Bruhn et al. demonstrated elevated systolic blood pressures and symptoms of anxiety. Leigh et al. compared open vs. closed ICUs, corroborating the observations of other workers. They found that closed units provided privacy at the expense of human interactions, resulting in increased feelings of loneliness and displacement of hostile feelings. The open unit was observed as providing greater social contact with associated freedom of expression of hostile feelings, while the lack of privacy resulted in higher levels of "shame" anxiety. On the basis of these and other observations, they suggested that some individuals will do better in one setting and/or that an ideal CCU could be designed to provide for both togetherness and privacy. Some units have already incorporated this plan with folding partitions that can be closed at the time of nursing procedures, and open at other times to provide for communication with other patients.

3. **Psychiatric reactions** produced by the ICU environment and experience that manifest themselves after discharge from the unit.

Klein et al., and Dominian and Dobson have found heightened anxiety, associated with cardiovascular distress, in patients at the time of and following discharge from the ICU. Correlating these emotional changes with increased urinary catecholamines, Klein subsequently demonstrated that cardiovascular complications were reduced in patients prepared for transfer and followed by the same nurse and physician throughout hospitalization.

Kimball has observed that many patients experiencing delirium with hallucinations and delusions during the ICU period continue to have obsessional preoccupations with this experience as part of an acute depression following sudden hospitalization.

4. **Emotional reactions of the ICU staff.**

Not the least of considerations found by Kornfeld is the emotional reactions of the staff. If the stresses and strains of the ICU are burdensome to the patient and his family, they are equally so for the ICU staff, attending simultaneously to a number of patients, each of whom is critically ill, and physiologically and psychologically labile to any one of a number of potential complications demanding immediate recognition and intervention. Vreeland and Ellis, Cassem et al., and Hay and Oken, have described the pivotal role of the nurse in the ICU. They have compared the nurse's objective role, i.e., the need for technical competence, decisive and controlled response to a chronic

state of emergency, and constant vigilance, with her subjective one, i.e., interacting with patients and relatives, handling the fatigue and brusqueness of physicians, and containing her own emotions. They have proposed that these factors be considered in the training and scheduling of nurses. Some hospitals now arrange for intermittent rotation of ICU nurses to general-nursing floors and for the opportunity to ventilate feelings in group discussion with nurses and administrators within their own hospital as well as from other centers.

Attention to these environmental and personnel factors is needed as a crucial prelude for the patient's hospitalization and eventual rehabilitation and adjustment.

Cardiovascular Surgery

Since cardiac surgery was first performed, severe behavioral postoperative states have been observed. Blachly and Starr have given the name postcardiotomy delirium to these states. This condition is described as occurring suddenly three to five days following surgery after an untoward early postoperative period. The delirium is marked by increasing confusion, progressing to delusions and hallucinations. Blachly and associates attribute this condition to an abnormal metabolic state and postulate the presence of psychotoxic metabolites.

Studies have suggested that not only the physical condition but the psychological condition of the individual faced with surgery strongly influences the success or failure of cardiac surgery in terms of morbidity and mortality. Attempts to gain a clearer understanding of these conditions have focused on various aspects of the patient's hospital and surgical course. Janis has observed that the way in which a patient handles anxiety before an operation affects his postoperative course. Patients who denied or showed little or no anxiety and those who manifested overwhelming anxiety sustained greater postoperative morbidity than those patients who admitted to anxiety and demonstrated moderately intact and mature defenses in coping with it.

Abram has verified that patients with high anxiety preoperatively are more likely to experience a postcardiotomy delirium. He explains the occurrence of this psychoticlike state as a defense against the anxiety over the possibility of death. Meyer et al. have suggested that this condition arises out of the patient's misperceptions in the early postoperative period, occurring while he is still under the influence of anesthesia and adjunctive agents such as the anticholinergics. They also postulate that in his semidrugged state the individual misperceives what is going on in an unfamiliar environment, picking up fragments from this which he may subsequently attempt to fit together in what is projected as an unreal delusional sequence.

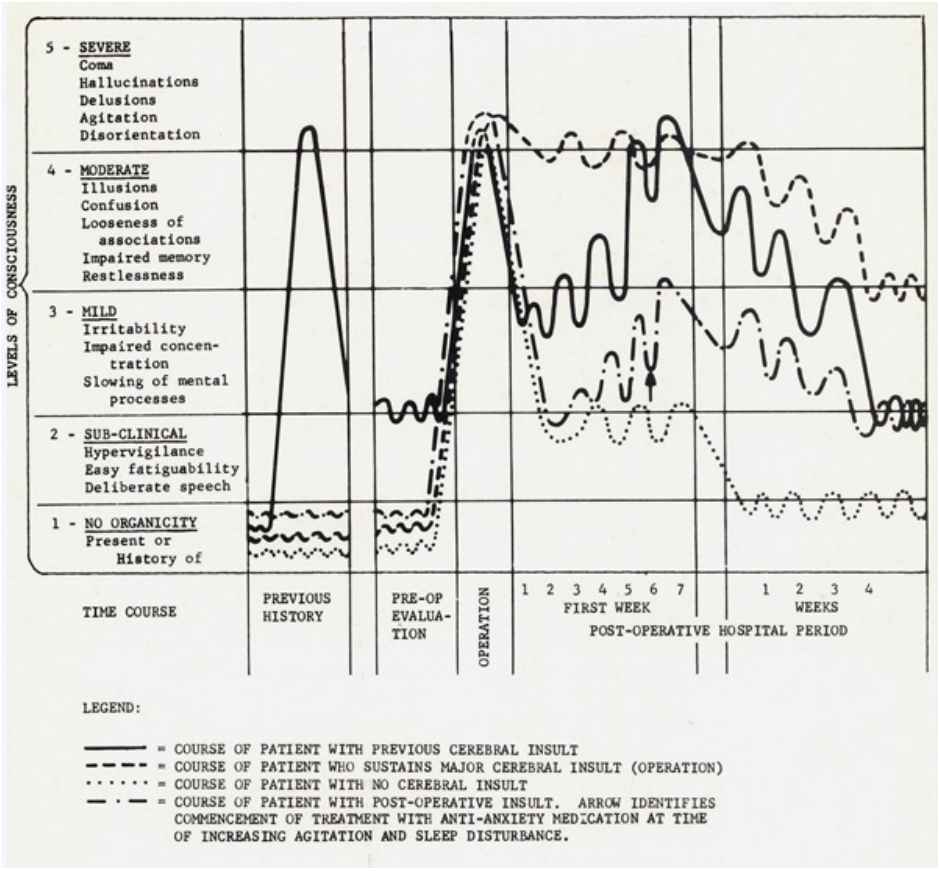
Kornfeld et al. emphasized the possible contributing effects of the recovery room (RR) or ICU.123,124 Here was an environment of simultaneous sensory overstimulation and monotony in terms of the repetitive beeping sounds of cardiac monitors, the hissing of oxygen and suction apparatuses, the intermittent clacking of automatic blood-pressure recordings. The patient was constantly aroused by nursing staff carrying out necessary medical observations and procedures. Sleep was only possible in short sequences. The patient's communication was disrupted because of oxygen masks, tracheotomies, and the suppression of cognitive processes (orientation, memory, concentration, and abstraction) associated with analgesics and sedatives. In the case of cardiac surgery, the environment becomes further distorted by the introduction of hypothermia, and, for the coronary patient in rarer instances, by the use of hyperbaric chambers. Not only was the patient estranged from those in the immediate environment by machines and sounds, but in a large measure, the ICU was similarly isolated from the rest of the world. Windows in these units were rare. Lights were kept on at all times obliterating day-night sequences, distorting circadian rhythms, and ultimately the patient's time sense and orientation. Clocks and calendars were absent. Regular meal times were not observed. Familiar objects were nowhere to be seen. The personnel was strangely garbed and masked. Other patients were perceived as moaning heaps of white, while physically close enough at hand to compromise privacy, frequently far distant

in a communicative sense. No wonder then that patients admitted to these units often experienced confusion, disorientation, misperceptions, and, less frequently, manifested delusional and hallucinatory behavior associated with agitation interfering with medical care. In rarer instances, the disruptive behavior resulted in patients' ripping off intravenous and monitor attachments and fleeing from the unit followed by a mélange of attendants to the startled attention of the other patients. Komfeld's vivid description went beyond mere observation. He suggested a number of remediable factors which have since been introduced into the ICU that presumably have led to the reduction in the incidence of these behavioral states.

Kimball et al. following patients undergoing cardiac surgery, observed that the delirium identified by Blachly and others is almost always preceded by symptoms and signs suggesting progressive cognitive dysfunction from the first postoperative day, and is most frequent in individuals who reported prior compromise of cerebral functions. Early symptoms and signs included restlessness, agitation, mild confusion, complaints, and little or no sleep. These occurred in patients whose operative experience and postoperative course had been more severe. In other studies, Kimball found that patients who preoperatively denied anxiety and yet manifested considerable agitation, and those with marked depression were more likely to experience adjustment difficulties in the postoperative period and sustained greater morbidity and mortality. These patients responded to cognitive deficits with

heightened anxiety and depression which further compromised their ability to cope with the stresses of the postoperative environment. With increasing sleep deficits and the not infrequent complications, mild confusion became gross disorientation with increasing agitation, which, if left untreated, resulted in delusional and hallucinatory states (see Figure 26-4). Patients who had fairly successful life patterns before surgery enjoyed lower mortality, although those who had used illness as a means of adjusting to life situations showed greater morbidity postoperatively and had poorer overall results.

Figure 26-4.



Course of mental status of patients undergoing heart surgery.

Kennedy and Bakst identified six groupings of patients preoperatively as having predictive significance in terms of postoperative adjustment and outcome. Focusing on patients' expectations of surgery, they observed that patients with a long history of unsatisfactory life conditions approached

surgery consciously expressing a death wish. On the other hand, patients with congenital cardiac defects expressed optimism, viewing the repair as something owed to them and that correction would make them rightfully healthy. Patients who had used their illness in making life adjustments feared and later experienced profound readjustment problems when they no longer had severe disability to rely upon in negotiating their demands. Knox's experience with patients he classified as neurotics or hysterics on the basis of interviews and performance on the M-R section of the Cornell Medical Index showed similar poor postoperative adjustment.

Tufo et al. have correlated aberrant postoperative behavior with demonstrated neurological deficits and neuropathological lesions. Furthermore, they have shown that patients who had long intervals on extra-corporeal circulation and who had sustained blood pressures below 60 mm. Hg. were more vulnerable to postoperative delirium. Heller et al. demonstrated that patients with longer bypass times were more vulnerable to developing delirium, raising the interesting hypothesis of the possible role of the lung in metabolizing substances that, when accumulated, are "toxic to brain function.

Precise explanation for the various correlations are still in the process of evolution based upon more intensive research. Efforts are in progress to identify biological correlates of the emotional and behavioral states. Such

studies suggest, but do not conclusively prove, that the manner in which individuals confront experiences influence their subsequent psychological and physiological behavior in identical ways. For instance, a possible explanation why depressed patients are more likely to die is that the depressed state prevents them from augmenting sufficient physiological defenses to sustain the stress of the operative procedure. However, it is possible that depressed states and their biological correlates vary considerably from one individual to another.

Identifying in vulnerable patients preoperatively signs and symptoms of organicity, overwhelming anxiety and/or depression, and considering appropriate preoperative and/or postoperative intervention may help to diminish postoperative morbidity. Attention to the individual's expectations may be all important in whether or not he makes a satisfactory response. If expectations are unrealistic, if the patient expects rebirth and rejuvenation, and discovers in its place continued limitation and restriction, recovery and rehabilitation will be retarded. The preoperative and rehabilitative efforts of the staff need to include the family, especially the spouse. Attention to vocational, social, and domestic (including marital) expectations of the patient and his family is their responsibility. Without such attention, the social reintegration of the patient will be less than ideal and fraught with superimposed frustrations. The efforts of the staff do not cease with the event of successful surgery. The long road to recovery has only just begun, twists,

turns, and detours are many and can only be approached and overcome by the continued support, understanding, and foresight of the team.

Lazarus and Hagens have demonstrated the that patients who underwent a preoperative interview with a psychiatrist had lower mortality and morbidity than matched patients who were not afforded this experience. This observation has recently been substantiated by Layne and Yudofsky. Kimball noted in his original series of fifty-four patients that there was no occurrence of post-cardiotomy delirium at a time when other authors were reporting incidences as high as 40 percent. He attributed this finding to the manner in which patients had been prepared for surgery by the team. This included a week's hospitalization before surgery which provided an equilibration period during which the patient was seen daily, acquainted with the details of the procedure to be performed, exposed to the recovery room, instructed in several techniques to be used postoperatively, and talked with a psychiatrist.

Attention to the postoperative environment and an amelioration of the disruptive factors identified by Kornfeld, Heller et al., and McKegney, will go far in diminishing the incidence of postoperative delirium. Instructing the nursing staff in the ICU in the use of a scale similar to the Eleven Item Behavioral Rating Scale will lead to the early detection of cognitive deficits and will prevent gross behavioral disturbance through the appropriate

intervention. Judicious and cautious use of phenothiazines to diminish the anxiety underlying or associated with aberrant behavior, whatever its cause, has helped greatly in controlling behavior and bringing relief to the disturbed patient. Preparation of the patient for release as well as admission to the ICU, as stressed by Klein, will help prevent the occurrence of transfer anxiety, when the patient suddenly feels abandoned and on his own.

Lastly, for the physician and the team that works with these patients and wishes to sensitize himself to the subjective concerns of the patient undergoing cardiac surgery, reading of Rachel MacKenzie's *Risk* is essential.

Behavior and Conditioning Techniques

During the past decade, innovative research, based on new laboratory techniques, has led to renewed interest in the potential role of conditioning in the understanding and treatment of autonomic dysfunctions. Although this research is in its infancy and still of more theoretical interest than of practical application, enough experimental work has been accomplished to suggest that an extension of these techniques may become one of the major developments in medicine during this century.

Relaxation methods, often under conditions of hypersuggestibility or hypnosis, have from time to time been employed in the treatment of patients with chronic illness in which psychological factors have been implicated.

These methods, given emphasis by Jacobson in the 1930s, and Raab in the 1960s, have been derived in part from behavior therapy. Such methods remain in limited use. Raab emphasized the use of "retreats" by patients with cardiovascular problems in which somatic and autonomic relaxation could be effected through "regressive" individual and group experiences, including mud baths.

Gantt, and more recently Rifkin (after Wolpe), have emphasized classical conditioning methods in their work with patients with cardiac problems. Aiken and Henrichs have demonstrated relaxation techniques in patients following open-heart surgery. Although in limited use, partly because of little contact of students and physicians with them during training, the use of specific and more general conditioning methods have an important place in the rehabilitation of patients enduring disease processes in which changes in habits are deemed essential to their continued effectiveness and survival.

Most exciting is the work performed by Miller and his colleagues, Banuazizi, Carmona, and DiCara in operant conditioning or instrumental learning. In instrumental, as opposed to classical conditioning, reinforcement or reward may strengthen any immediately preceding response. In classical conditioning the reward achieves its desired effect only when the response to be learned is already elicited by an unconditional stimulus. Miller explains the relationship between these methods as different manifestations of the same

basic phenomenon under different conditions. He identifies similar laws as effecting both types of learning and assumes that there is essentially only one kind of learning.

Using curarized rats in order to ablate the affect of skeletal on visceral responses to be conditioned by instrumental learning, Miller and Trowill were able to demonstrate that increases or decreases in heart rate could be effected, using as a reward direct stimulation of the rewarding areas of the brain or as punishment a mild pain stimulus to the tail. Subsequently Miller and DiCara were able to effect greater changes in these responses through the techniques of shaping and to demonstrate that learning can be both brought under the control of a discriminative stimulus and retained. They were then able to show that operantly learned behavior under the influence of curare could be carried over to the noncurarized state, supporting the contention that this learning is effected directly through the visceral system rather than indirectly through the effect of learned motor behavior on visceral functions as summarized by Katkin and Murray. Such learning was also demonstrated to be specific for the condition rewarded and not generalized to other autonomic functions. In other words, cardiovascular functions such as blood pressure and heart rate could be independently conditioned in either direction. However, DiCara has observed greater “emotionality” occurring in animals conditioned to increase their heart rate, as compared to those conditioned to decelerate their heart rate following instrumental

conditioning. To date, operant learning, while it occurs, has been poorer in the noncurarized state than the curarized one, a phenomenon explained by Miller on the basis that the later state eliminates sources of distractability and variability. Because of initial success in effecting brain wave activity and associated behavior through instrumental learning techniques, Miller and his colleagues are at present attempting to modify the activity of a specific part of the vagal nucleus directly which holds potential for the instrumental regulation of cardiac activity.

The implications of this work are several. Understanding the individual specificity with which organisms react to similar stresses through their autonomic nervous system may be tentatively explained on the basis of the at first casual juxtaposition of a chance stress with such a response at a particularly vulnerable time in the development or structuring of that autonomic function under a specific environmental situation in which the gross behavior associated with the autonomic response was wittingly or unwittingly rewarded (reinforced).

With improvement and perfection of these techniques, their theoretical potential for use in altering visceral dysfunctions is viewed as unlimited. This has especial potential for cardiovascular disorders such as cardiac arrhythmias and hypertension, where preliminary human trials have suggested their applicability. Frazier et al. have shown that discriminative

avoidance conditioning leads to changes in the rate of response, the speed of the detection response, and the probability of signal detection, noting associated changes in heart rate, pulse pressure, skin resistance, and 17-hydroxycorticosteroid, epinephrine, and norepinephrine excretions. Headrick et al., with augmented sensory feedback techniques, effected heart-rate increases. They cited three dependent factors: (1) amount of training time required; (2) feedback; and (3) motivation. Weiss and Engel have reported success in using operant techniques in treating cardiac arrhythmias, work that has yet to be replicated by others. Plumlee has described increases in blood pressure under operant learning and Benson et al., and Shapiro et al., have achieved significant decreases in systolic blood pressures with these methods used on patients with essential hypertension. Whether these techniques will achieve long-term results awaits further trials and observations. In concluding this brief discussion, the authors are reminded of the long-observed changes in autonomic responses occurring in transcendental meditation or yoga.

Bibliography

Abram, H. S. and B. F. Gill. "Predictions of Postoperative Psychiatric Complications," *N. Engl. J. Med.,* 265 (1961), 1123-1128.

Adams, F. H. and A. J. Moss. "Physical Activity of Children with Congenital Heart Disease," *Am. J. Cardiol.,* 24 (1969), 605-606.

Adsett, C. A. and J. G. Bruhn. "Short term Group Psychotherapy for Post-myocardial Infarction

Patients and Their Wives," *Can. Med. Assoc. J.,* 99 (1968), 577-584.

Aiken, L. H. and T. F. Henrichs. "Systematic Relaxation as a Nursing Intervention Technique with Open Heart Surgery Patients," *Nurs. Res.,* 20 (1971), 212-217.

Alexander, F. "Emotional Factors in Essential Hypertension," *Psychosom. Med.,* 1 (1939), 173-179.

Alexander, H., de M. "A Few Observations on the Blood Pressure in Mental Disease," *Lancet* (July 5, 1902), 18-20.

Altschule, M. D. *Bodily Physiology in Mental and Emotional Disorders,* pp. 23-24 New York: Grune & Stratton, 1953.

Arlow, J. A. "Anxiety Patterns in Angina Pectoris," *Psychosom. Med.,* 14 (1952), 461-468.

Ax, A. F. "The Physiological Differentiation between Fear and Anger in Humans," *Psychosom. Med.,* 15 (1953), 433-442.

Bahnson, C. B. and W. I. Wardwell. "Parent Constellation and Psychosexual Identification in Male Patients with Myocardial Infarction," *Psychol. Rep.,* 10, 3-V10 (Monograph Suppl.) (1962), 831-852.

Bakker, C. B. and R. M. Levenson. "Determinants of Angina Pectoris," *Psychosom. Med.,* 29 (1967), 621-633.

Barnes, R. and W. Schottstaedt. "The Relation of Emotional State to Renal Excretion of Fluids and Electrolytes in Patients with Congestive Heart Failure," *Clin. Res.,* 6 (1958), 224.

Bendian, J. and J. Groen. "A Psychological-Statistical Study of Neuroticism and Extraversion in Patients with Myocardial Infarction," *J. Psychosom. Res.,* 7 (1963), 11-14.

Benson, H., D. Shaprio, B. Tursky et al. "Decreased Systolic Blood Pressure through Operant Conditioning Techniques in Patients with Essential Hypertension," *Science,* 173 (1971), 740-741.

Bilodeau, C. B. and T. P. Hackett. "Issues Raised in a Group Setting by Patients Recovering from

Myocardial Infarction," *Am. J. Psychiatry,* 128 (1971), 73-78.

Binger, C. "On So-called Psychogenic Influences in Essential Hypertension," *Psychosom. Med.,* 13 (1951), 273-276.

Blacher, R. S. and S. H. Basch. "Psychological Aspects of Pacemaker Implantation," *Arch. Gen. Psychiatry,* 22 (1970), 319-323.

Blachly, P. H. "Open Heart Surgery: Physiological Variables of Mental Functioning," *Int. Psychiatry Clin.,* 4 (1967), 133-155-

Blachly, P. H. and A. Starr. "Post-cardiotomy Delirium," *Am. J. Psychiatry,* 121 (1964), 317-375.

----. "Treatment of Delirium with Phenothiazine Drugs following Open Heart Surgery," *Dis. Nerv. Syst.,* 27 (1966), 107-110.

Bolt, W., M. F. Bell, and J. R. Harnes. "A Study of Mortality in Moderate and Severe Hypertension," *Trans. Assoc. Life Ins. Med. Dir. Am.,* 41 (1958), 61.

Boyle, E., Jr. "Biological Patterns in Hypertension by Race, Sex, Body Weight, and Skin Color," *JAMA,* 213 (1970), 1637-1643.

Brod, J. "Haemodynamics and Emotional Stress," *Bibl. Psychiatr.,* 144 (1970), 13-33.

Brower, D. "The Relation between Certain Rorschach Factors and Cardiovascular Activity before and after Visuo-Motor Conflict," *J. Gen. Psychiatry,* 37 (1947), 93-95.

Brozek, J. "Personality Differences between Potential Coronary and Noncoronary Subjects," *Ann. N.Y. Acad. Sci,* 134 (1966), 1057-1064.

Bruhn, J. G., B. Chandler, M. C. Miller et al. "Social Aspects of Coronary Heart Disease in Two Adjacent Ethnically Different Communities," *Am. J. Public Health,* 57 (1966), 1493-1506.

Bruhn, J. G., B. Chandler, and S. Wolf. "A Psychological Study of Survivors and Nonsurvivors of Myocardial Infarction," *Psychosom. Med.,* 31 (1969), 8-19.

Bruhn, J. G., A. E. Thurman, Jr., B. C. Chandler et al. “Patients’ Reactions to Death in a Coronary Care Unit,” *J. Psychosom. Res.,* 14 (1970), 65-70.

Brunner, H. R., J. H. Laragh, L. Baer et al. “Essential Hypertension: Renin and Aldosterone, Heart Attack and Stroke,” *N. Engl. J. Med.,* 286 (1972), 441-449.

Caffrey, B. “A Multivariate Analysis of Sociopsychological Factors in Monks with Myocardial Infarctions,” *Am. J. Public Health,* 60 (1970), 452-458.

Cassel, J., S. Heyden, A. G. Bartel et al. “Incidence of Coronary Heart Disease by Ethnic Groups, Social Class, and Sex,” *Arch. Intern. Med.,* 128 (1971), 901-906.

Cassem, N. H. and T. P. Hackett. “Psychiatric Consultation in a Coronary Care Unit,” *Ann. Intern. Med.,* 75 (1971), 9-14.

Cassem, N. H., T. P. Hackett, C. Bascom et al. “Reactions of Coronary Patients to the Coronary Care Unit Nurse,” *Am. J. Nursing,* 70 (1970), 319-324.

Cassem, N. H., H. A. Wishnie, and T. P. Hackett. “Response of Coronary Patients to Last Rites,” *Postgrad. Med.,* 45 (1969), 147-152.

Chagan, M., T. Hanes, D. O’Neill et al. “The Intellectual and Emotional Development of Children with Congenital Heart Disease,” *Guys Hosp. Rep.,* 100 (1951), 331-341.

Chambers, W. N. and M. F. Reiser. “Emotional Stress in the Precipitation of Congestive Heart Failure,” *Psychosom. Med.,* 15 (1953), 38-60.

Cleveland, S. E. and D. L. Johnson. “Personality Patterns in Young Males with Coronary Disease,” *Psychosom. Med.,* 24 (1962), 600-610.

Cohen, S. and O. A. Parsons. “The Perception of Time in Patients with Coronary Artery Disease,” *J. Psychosom. Res.,* 8 (1964), 1-7.

Crisp, A. H. and E. Stonehill. “Aspects of the Psychological Status of Patients Treated with Cardiac Pacemakers,” *Postgrad. Med.,* 45 (1969), 423-427.

Croog, S. H. and S. Levine. “Social Status and Subjective Perceptions of 250 Men after Myocardial Infarction,” *Public Health Rep.,* 84 (1969), 989-997.

Croog, S. H., D. Shapiro, and S. Levine. “Denial among Male Heart Patients: An Empirical Study,” *Psychosom. Med.,* 33 (1971), 385-397.

Datey, K. K., S. N. Deshmukh, C. P. Dalvi et al. “ ‘Sahvasan’: A Yogic Exercise in the Management of Hypertension,” *Angiology,* 20 (1969), 325-333.

Davies, M. “Blood Pressure and Personality,” *J. Psychosom. Res.,* 14 (1970), 89-104.

Dawber, T. R. and W. B. Kannel. “Atherosclerosis and You: Pathogenic Implications from Epidemiologic Observations,” *J. Am. Geriatr. Soc.,* 10 (1962), 805-821.

DiCara, L. V. and N. E. Miller. “Instrumental Learning of Systolic Blood Pressure Responses by Curarized Rats; Dissociation of Cardiac and Vascular Changes,” *Psychosom. Med.,* 30 (1968), 489-494.

----. “Long-Term Retention of Instrumentally Learned Heart-Rate Changes in the Curarized Rat,” *Comment. Behav. Biol.,* 2 (1968), 19-23.

Dlin, B. M. and H. K. Fischer. “Psychologic Adaptation to Pacemaker and Open Heart Surgery,” *Arch. Gen. Psychiatry,* 19 (1968), 599-610.

Dominian, J. and M. Dobson. “Study of Patients’ Psychological Attitudes to a Coronary Care Unit,” *Br. Med. J.*, 4 (1969), 795-798.

Donaldson, J. F. “Patterns of Disease in Rhodesia Central Africa,” *J. Med.,* 17 (1971), 51-53.

Doyle, J. T., T. R. Dawber, W. B. Kannel et al. “Cigarette Smoking and Coronary Heart Disease,” *N. Engl. J. Med.,* 266 (1962), 796-801.

Dreyfuss, F., H. Dasberg, and M. I. Assael. “The Relationship of Myocardial Infarction to Depressive Illness,” *Psychother. Psychosom.,* 17 (1969), 73-81.

Dreyfuss, F., J. Shanan, and M. Sharon. “Some Personality Characteristics of Middle-Aged Men

with Coronary Artery Disease," *Psychother. Psychosom.,* 14 (1966), 1-16.

Druss, R. G. and D. S. Kornfeld. "The Survivors of Cardiac Arrest," *JAMA,* 201 (1967), 291-296.

Dunbar, F. *Emotions and Bodily Changes,* pp. 331-361. New York: Columbia University Press, 1954.

Eliasson, S., B. Folkow, P. Linogren et al. "Activation of Sympathetic Vasodilator Nerves to the Skeletal Muscle in the Cat by Hypothalamic Stimulation," *Acta Physiol. Scand.,* 27 (1953), 18-37.

Engel, G. L. "Sudden and Rapid Death during Psychological Stress," *Ann. Intern. Med.,* 74 (1971), 771-782.

Epstein, F. H. "Epidemiologic Aspects of Atherosclerosis," *Atherosclerosis,* 14 (1971), 1-11.

Erikson, E. *Childhood and Society,* pp. 274. New York: Norton, 1963.

Fisher, S. H. "Psychological Factors and Heart Disease," *Circulation,* 27 (1963), 113-117.

Fox, H. M. "Physiological Response of the Adrenal to Psychological Influences as Indicated by Changes in the 17-Hydroxycorticosteroid Excretion Pattern," in G. E. W. Walstenholme, ed., *Ciba Foundation Colloquia on Endocrinology,* Vol. 8, p. 612. London: Churchill, 1955.

Fox, H. M., B. J. Murawski, G. W. Thorn et al. "Urinary 17-Hydroxycorticoid and Uropepsin Levels with Psychological Data. A Three-Year Study of One Subject," *Arch. Intern. Med.,* 101 (1958), 859-871.

Frazier, T. W., H. Weil-Malherbe, and H. S. Lipscomb. "Psychophysiology of Conditioned Emotional Disturbances in Humans," *Psychophysiology,* 5 (1969), 478-503.

Friedman, E. H. and H. K. Hellerstein. "Occupational Stress, Law School Hierarchy, and Coronary Artery Disease in Cleveland Attorneys," *Psychosom. Med.,* 30 (1968), 72-86.

Friedman, M., S. O. Byers, R. H. Rosenman et al. "Coronary-Prone Individuals (Type A Behavioral

Pattern) Growth Hormone Response," *JAMA,* 217 (1971), 929-932.

Friedman, M. and R. H. Rosenman. "Association of Specific Overt Behavior Pattern with Blood and Cardiovascular Findings," *JAMA,* 169 (1959), 1286-1296.

----. "Overt Behavior Pattern in Coronary Disease: Detection of Overt Behavior Pattern A in Patients with Coronary Disease by a New Psychophysiological Procedure," *JAMA,* 173 1960), 1320-1325.

Friedman, M., R. H. Rosenman, R. Straus et al. "The Relationship of Behavior Pattern A to the State of the Coronary Vasculature," *Am. J. Med.,* 44 (1968), 525-537.

Funkenstein, D. H., S. H. King et al. "The Experimental Evocation of Stress," in *Symposium on Stress,* p. 304. Washington: Army Medical Service Graduate School, 1953.

Gantt, W. H. "The Meaning of the Cardiac Conditioned Reflex," *Cond. Reflex,* 1 (1966), 139-143.

Garfinkel, L. "The Association between Cigarette Smoking and Coronary Heart Disease and Other Vascular Diseases," *Bull. N.Y. Acad. Med.,* 44 (1968), 1495-1501.

Garner, H. H. and M. A. Falk. "Recognizing the Patient with Pseudoangina," *Geriatrics,* 25 (1970), 87-92.

Geiger, H. J. and N. A. Scotch. "The Epidemiology of Essential Hypertension. I. Biologic Mechanisms and Descriptive Epidemiology," *J. Chronic Dis.,* 16 (1963), 1151-1182.

Goldstein, H. S., H. Pardes, A. M. Small et al. "Psychological Differentiation and Specificity of Response," *J. Nerv. Ment. Dis.,* 151 (1970), 97-103.

Gordon, T. "Mortality Experience among Japanese in the United States, Hawaii, and Japan," *Public Health Rep.,* 72 (1957), 543-553.

Graham, D. T., J. D. Kabler, and F. K. Graham. "Physiological Response to the Suggestion of Attitudes Specific for Hives and Hypertension," *Psychosom. Med.,* 24 (1962), 159-169.

Greene. W. A., G. Conron, D. S. Schalch et al. “Psychological Reactions with Changes in Growth Hormone and Cortisol Levels: A Study of Patients Undergoing Cardiac Catheterization,” *Psychosom. Med.,* 32 (1970), 599-614.

Greene, W. A. and A. J. Moss. “Psychosocial Factors in the Adjustment of Patients with Permanently Implanted Cardiac Pacemakers,” *Ann. Intern. Med.,* 5 (1969), 897-902.

Gressel, G. C., F. O. Shobe, G. Sallow et al. “Personality Factors in Arterial Hypertension,” *JAMA,* 140 (1949), 265-272.

Groen, J. J., J. M. Van der Valk, A. Welner et al. “Psychobiological Factors in the Pathogenesis of Essential Hypertension,” *Psychother. Psychosom.,* 19 (1971), 1-26.

Grollman, A. “Effect of Psychic Disturbances on the Cardiac Output, Blood Pressure, and Oxygen Consumption in Man,” *Am. J. Physiol.,* 89 (1929), 584-593.

Hackett, T. P. and N. H. Cassem. “Factors Contributing to Delay in Responding to Signs and Symptoms of Acute Myocardial Infarction,” *Am. J. Cardiol.,* 24 (1969), 651-658.

Hackett, T. P., N. H. Cassem, and H. A. Wishnie. “The Coronary Care Unit: An Appraisal of Its Psychological Hazards,” *N. Engl. J. Med.,* 279 (1968), 1365-1370.

----. “Detection and Treatment of Anxiety in the Coronary Care Unit,” *Am. Heart J*., 78 (1969), 727-730.

Harburg, E., W. J. Schull, J. C. Erfurt et al. “A Family Set Method for Estimating Heredity and Stress. I. A Pilot Study of Blood Pressure Among Negroes in High and Low Stress Areas. Detroit 1966-1967,” *J. Chronic Dis.,* 23 (1970), 69-81.

Harris, R. E., M. Sokolow, L. G. Carpenter, Jr. et al. “Response to Psychologic Stress in Persons Who Are Potentially Hypertensive,” *Circulation,* 7 (1953), 874-879.

Hatch, F. T., P. K. Reissell, T. M. W. Poon-King et al. “A Study of Coronary Heart Disease in Young Men. Characteristics and Metabolic Studies of the Patients and Comparison with Age-Matched Healthy Men,” *Circulation,* 33 (1966), 679-703.

Hay, D. and D. Oken. "The Psychological Stresses of Intensive Care Unit Nursing," *Psychosom. Med.,* 34 (1972), 109-118.

Headrich, M. W., B. W. Feather, and D. T. Wells. "Unidirectional and Large Magnitude Heart Rate Changes with Augmented Sensory Feedback," *Psychophysiology,* 8 (1971), 132-142.

Heine, B. E., P. Sainsbury, and R. C. Chynoweth. "Hypertension and Emotional Disturbance," *J. Psychiatr. Res.,* 7 (1969), 119-130.

Heller, S. S., K. A. Frank, J. R. Malm et al. "Psychiatric Complications of Open-Heart Surgery," *N. Engl. J. Med.,* 283 (1970), 1015-1020.

Hellerstein, H. K. and E. H. Friedman. "Sexual Activity and the Post-Coronary Patient," *Arch. Intern. Med.,* 125 (1970), 987-999.

Henry, J. P. and J. C. Cassel. "Psychosocial Factors in Essential Hypertension. Recent Epidemiologic and Animal Experimental Evidence," *Am. J. Epidemiol.,* 90 (1969). 171-200.

Henry, J. P., J. P. Meehan, and P. M. Stephans. "The Use of Psychosocial Stimuli to Induce Prolonged Hypertension in Mice," *Psychosom. Med.,* 29 (1967), 408-432.

Henry, J. P., P. M. Stephans, J. Axelrod et al. "Effect of Psychosocial Stimulation on the Enzymes Involved in the Biosynthesis and Metabolism of Noradrenaline and Adrenaline," *Psychosom. Med.,* 33 (1971), 227-237.

Hickam, J. B., W. H. Cargill, and A. Golden. "Cardiovascular Reactions to Emotional Stimuli: Effect on Cardiac Output, Arteriovenous Oxygen Difference, Arterial Pressure, and Peripheral Resistance," *J. Clin. Invest.,* 27 (1948), 290-323.

Hinkle, L. E. "Some Social and Biological Correlates of Coronary Artery Disease," *Soc. Sci. Med.,* 1 (1967), 129-139.

Hinkle, L. E., L. H. Whitney, E. W. Lehman et al. "Occupation, Education and Coronary Heart Disease," *Science,* 161 (1968), 238-246.

Hovarth, S. M. "Cardiac Disease in the Context of the Future Environment," *Environ. Res.,* 2 (1969),

470-475.

Ibrahim, M. A., C. D. Jenkins, J. C. Cassel et al. "Personality Traits and Coronary Heart Disease," *J. Chronic Dis.,* 10 (1955), 255-271.

Itil, T. and M. Fink. "Anticholinergic Drug-Induced Delirium: Experimental Modification, Quantitative EEG, and Behavioral Correlations," *J. Nerv. Ment. Dis.,* 142 (1966), 492-507.

Jacobson, E. *Progressive Relaxation.* Chicago: University of Chicago Press, 1938.

Janis, I. L. *Psychological Stress. Psychoanalytic and Behavioral Studies of Surgical Patients.* New York: Wiley, 1958.

Jenkins, C. D. "Psychologic and Social Precursors of Coronary Artery Disease (Part 1)," *N. Engl. J. Med.,* 284 (1971), 244-255.

----. "Psychologic and Social Precursors of Coronary Artery Disease (Concluded)," *N. Engl. J. Med.,* 284 (1971), 307-317.

Jenkins, C. D., S. J. Zyzanski, and R. H. Rosenman. "Progress toward Validation of a Computer-Scored Test for the Type A Coronary-Prone Behavior Pattern," *Psychosom. Med.,* 33 (1971), 193-202.

Jenkins, C. D., S. J. Zyzanski, R. H. Rosenman et al. "Association of Coronary-Prone Behavior Scores with Recurrence of Coronary Heart Disease," *J. Chronic Dis.,* 24 (1971), 601-611.

Kannel, W. B., J. LeBauer, T. R. Dawber et al. "Obesity and Coronary Heart Disease," *Circulation,* 35 (1967), 734-744.

Kaplan, S. M., L. A. Gottschalk, E. B. Magliocco et al. "Hostility in Verbal Productions and Hypnotic Dreams of Hypertensive Patients," *Psychosom. Med.,* 23 (1961), 311-322.

Kasl, S. V. and S. Cobb. "Blood Pressure Changes in Men Undergoing Job Loss: A Preliminary Report," *Psychosom. Med.,* 32 (1970), 19-38.

Katkin, E. S. and N. E. Murray. "Instrumental Conditioning of Autonomically Mediated Behavior: Theoretical and Methodological Issues," *Psychol. Bull.,* 70 (1968), 52-68.

Katz, L. N. "The Mechanism of Cardiac Failure," *Circulation,* 10 (1954), 663-679.

Katz, L. N., S. S. Winton, and R. Megibow. "Psychosomatic Aspects of Cardiac Arrhythmias," *Ann. Intern. Med.,* 27 (1947), 261-274.

Keith, R. A. "Personality and Coronary Heart Disease: A Review," *J. Chronic Dis.,* 19 (1966), 1231-1243.

Kennedy, J. A. and H. Bakst. "The Influence of Emotions on the Outcome of Cardiac Surgery: A Predictive Study," *Bull. N.Y. Acad. Med.,* 42 (1966), 811-849.

Keys, A. "Diet and the Epidemiology of Coronary Heart Disease," *JAMA,* 164 (1957), 1912.

Kimball, C. P. "Psychological Responses to the Experience of Open-Heart Surgery. I," *Am. J. Psychiatry,* 125 (1969), 348-359.

----. "The Experience of Open-Heart Surgery. II. Determinants of Post-operative Behavior," Proc. 8th Europ. Conf. Psychosom. Med., 1970. *Psychother. Psychosom.,* 18 (1970), 259-274.

----. "The Experience of Open-Heart Surgery. III. Toward a Definition and Understanding of Post-cardiotomy Delirium," *Arch. Gen. Psychiatry,* 27 (1972), 57-63.

Kimball, C. P., D. M. Quinlan, F. Osborne et al. "The Experience of Cardiac Surgery. V. Psychological Patterns and Prediction of Outcome," Proc. 9th Europ. Conf. Psychosom. Med., Vienna, 1972. *Psychother. Psychosom.,* 22 (1973), 310-319.

Kimball, C. P. and J. V. Magnuson. "Depression and Contraception," in P. Zuspan and M. D. Lindeheimer, eds., *Medical Complications of Pregnancy.* New York: Lea & Feiber, forthcoming.

Klein, R. F., V. A. Kliner, D. P. Zipes et al. "Transfer from a Coronary Care Unit," *Arch. Intern. Med.,* 122 (1968), 104-108.

Knox, S. J. “Psychiatric Aspects of Mitral Valvotomy,” *Br. J. Psychiatry,* 109 (1963), 656-668.

Kornfeld, D. S. “Psychiatric Problems of an Intensive Care Unit,” *Med. Clin. North Am.,* 55 (1971), 1353-1363.

Kornfeld, D. S., S. Zimberg, and J. R. Malm. “Psychiatric Complications of Open-Heart Surgery,” *N. Engl. J. Med.,* 273 (1965). 287-292.

Koster, M. “Patterns of Hypertension,” *Bihl. Psychiatr.,* 144 (1970), 1-8.

Lacey, J. I., D. E. Bateman, and R. Van Lehn. “Autonomic Response Specificity: An Experimental Study,” *Psychosom. Med.,* 15 (1953), 8-21.

Lacey, J. I. and R. Van Lehn. “Differential Emphasis in Somatic Response to Stress,” *Psychosom. Med.,* 14 (1952), 71-81.

Laragh, J. H. “The Pill, Hypertension, and the Toxemias of Pregnancy,” *Am. J. Obstet. Gynec.,* 109 (1971), 210-213.

----. “Mechanisms of Edema Formation and Principles of Management,” *Am. J. Med.,* 21 (1956), 423.

Layne, O. L., Jr. and S. C. Yudofsky. “Post-operative Psychosis in Cardiotomy Patients,” *N. Engl. J. Med.,* 284 (1971), 518-520.

Lazarus, H. R. and J. H. Hagens. “Prevention of Psychosis following Open-Heart Surgery,” *Am. J. Psychiatry,* 124 (1968), 1190-1195.

Lebovits, B. Z., R. B. Schkelle, A. M. Ostfeld et al. “Prospective and Retrospective Psychological Studies of Coronary Heart Disease,” *Psychosom. Med.,* 29 (1967), 265-272.

Leigh, H., M. Hofer, J. Cooper et al. “A Psychological Comparison of Patients in ‘Open’ and ‘Closed’ Coronary Care Units,” (Am. Psychosom. Ann. Meet., Abstract), *Psychosom. Med.,* 33 (1971), 476.

Leon, A. S. and W. B. Abrams. “The Role of Catecholamines in Producing Arrhythmias,” *Am. J. Med.*

Sci., 262 (1971), 9-13.

Leutscher, J. A. and B. B. Johnson. "Observations on the Sodium-Retaining Corticoid (Aldosterone) in the Urine of Children and Adults in Relation to Sodium Balance and Edema," *J. Clin. Invest.,* 33 (1954), 1441-1446.

Levi, L. "Emotional Stress and Sympatho-Adrenomedullary and Related Physiological Reactions with Particular Reference to Cardiovascular Pathology," *Bibl. Psychiatr.,* 144 (1970), 38-51.

Liljefors, I. and R. H. Rahe. "An Identical Twin Study of Psychosocial Factors in Coronary Heart Disease in Sweden," *Psychosom. Med.,* 32 (1970), 523-542.

Lynn, D. B., H. H. Glaser, and G. S. Harrison. "Comprehensive Medical Care for Handicapped Children: III. Concepts of Illness in Children with Rheumatic Fever," *Am. J. Dis. Child,* 103 (1962), 120.

McKegney, F. P. "The Intensive Care Syndrome. The Definition, Treatment and Prevention of a New 'Disease of Medical Progress'," *Conn. Med.,* 30 (1966), 633-636.

----. "After the Coronary Care Unit: Three Transitions," in M. A. F. Pranulis, ed., *After the Coronary Care Unit—Then What?,* pp. 3-13. Proceedings of a symposium sponsored by the Greater Bridgeport Heart Association, December 3, 1969. Bridgeport, Conn.: Connecticut Regional Medical Program.

McKegney, F. P. and R. B. Williams. "Psychological Aspects of Hypertension. II. The Differential Influence of Interview Variables on Blood Pressure," *Am. J. Psychiatry,* 123 (1967), 1539-1545.

MacKenzie, R. *Risk.* New York: Viking, 1971

Mai, F. M. M. "Personality and Stress in Coronary Disease," *J. Psychosom. Res.,* 12 (1968), 275-287.

Mainzer, F. and M. Krause. "Influence of Fear on Electrocardiogram," *Br. Heart J.,* 2 (1940), 221-230.

Margolis, G. J. "Postoperative Psychosis on the Intensive Care Unit," *Compr. Psychiatry,* 8 (1967), 227-232.

Marriott, H. J. L. and P. M. Nizet. "Physiological Stimuli Simulating Ischemic Heart Disease," *JAMA,* 200 (1967), 139.

Merrill, A. J. "Edema and Decreased Renal Blood Flow in Patients with Chronic Congestive Heart Failure," *J. Clin. Invest.,* 25 (1946), 389-400.

Meyer, B. C., R. S. Blacher, and F. Brown. "A Clinical Study of Psychiatric and Psychological Aspects of Mitral Surgery," *Psychosom. Med.,* 23 (1961), 194-218.

Miller, M. L. "Blood Pressure Findings in Relation to Inhibited Aggressions in Psychotics," *Psychosom. Med.,* 1 (1939), 162-172.

Miller, N. E. "Learning of Visceral and Glandular Responses," *Science,* 163 (1969), 434-445.

Miller, N. E. and A. Banuazizi. "Instrumental Learning by Curarized Rats of a Specific Visceral Response, Intestinal or Cardiac," *J. Compr. Physiol. Psychol.,* 65 (1968), 1-7.

Miller, N. E. and A. Carmona. "Modification of a Visceral Response, Salivation in Thirsty Dogs by Instrumental Training with Water Reward," *J. Compr. Physiol. Psychol.,* 63 (1967), 1-6.

Minc, S. "Psychological Factors in Coronary Heart Disease," *Geriatrics,* 20 (1965), 747-755

Minc, S., G. Sinclair, and R. Taft. "Some Psychological Factors in Coronary Heart Disease," *Psychosom. Med.,* 25 (1963), 133-139

Moos, R. H. and B. T. Engel. "Psychophysiological Reactions in Hypertensive and Arthritic Patients," *J. Psychosom. Res.,* 6 (1962), 227-241.

Mordkoff, A. M. and O. A. Parsons. "The Coronary Personality: A Critique," *Psychosom. Med.,* 29 (1967), 1-14.

Moses, L., G. E. Daniels, and J. L. Nicker son. "Psychogenic Factors in Essential Hypertension:

Methodology and Preliminary Report," *Psychosom. Med.,* 18 (1956), 471-485.

Nahum, L. H. "Madness in the Recovery Room from Open Heart Surgery or 'They Kept Waking Me Up'," *Conn. Med.,* 29 (1966), 771-772.

Olin, H. S. and T. P. Hackett. "The Denial of Chest Pain in 32 Patients with Acute Myocardial Infarction," *JAMA,* 190 (1964), 977-981.

Ostfeld, A. M. and B. Z. Lebovits. "Personality Factors and Pressor Mechanisms in Renal and Essential Hypertension," *Arch. Intern. Med.,* 104 (1959), 59-68.

Paffenbarger, R. S., Jr. "Chronic Disease in Former College Students. VI. Implications for College Health Programs," *J. Am. Coll. Health Assoc.,* 16 (1967), 51-55.

Paffenbarger, R. S., Jr., J. Notkin, D. E. Krueger et al. "Chronic Disease in Former College Students. II. Methods of Study and Observations on Mortality from Coronary Heart Disease," *Am. J. Public Health,* 56 (1966), 962.

Paffenbarger, R. S., Jr., P. A. Wolf, J. Notkin et al. "Chronic Disease in Former College Students. I. Early Precursors of Fatal Coronary Heart Disease," *Am. J. Epidemiol.,* 83 (1966), 314-328.

Page, I. H. In Ciba Symposium, *Hypertension.* Berlin: Springer, 1966.

Paul, O. "Myocardial Infarction and Sudden Death," *Hosp. Practice,* 6 (1971), 91-108.

Paulk, E. A., Jr. "Clinical Problems of Cardioversion," *Am. Heart J.,* 70 (1965), 248-274.

Pelser, H. E. "Psychological Aspects of the Treatment of Patients with Coronary Infarct," *J. Psychosom. Res.,* 11 (1967), 47-49

Penaz, J. "The Blood Pressure Control System: A Critical and Methodological Introduction," *Bibl. Psychiatr.,* 144 (1970), 125-150.

Perlman, L. V., S. Ferguson, K. Bergum et al. "Precipitation of Congestive Heart Failure: Social and Emotional Factors," *Ann. Intern. Med.,* 75 (1971), 1-7.

Peters, J. P. "The Problem of Cardiac Edema," *Am. J. Med.,* 12 (1952), 66-76.

Pickering, G. *The Nature of Essential Hypertension.* London: Churchill, 1961.

Pinderhughes, C. A. and C. A. Perlman. "Psychiatric Aspects of Idiopathic Cardiomyopathy," *Psychosom. Med.,* 31 (1969), 57-67.

Pitts, R. F. "Some Reflections on Mechanisms of Action of Diuretics," *Am. J. Med.,* 24 (1958), 745-763

Plumlee, L. A. "Operant Conditioning of Increases in Blood Pressure," *Psychophysiology,* 6 (1969), 283-290.

Price, D. B., M. Thaler, and J. W. Mason. "Preoperative Emotional States and Adrenal Cortical Activity," *Arch. Neurol. Psychiatry,* 77 (1957), 646-656.

Quinlan, D. M., C. P. Kimball, and F. Osborne. "The Experience of Open Heart Surgery. IV. Assessment of Disorientation and Dysphoria Following Cardiac Surgery," *Arch. Gen. Psychiatry,* 31 (1974), 241-244.

Raab, W. *Organized Prevention of Degenerative Heart Disease: A Challenge to American Medicine and Economy.* Burlington, Vt.: Queens City Press, 1962.

----. "Emotional and Sensory Stress Factors in Myocardial Pathology," *Am. Heart J.,* 72 (1966), 538-564.

----. "The Preventable Neurogenic Causes of Hypoxic Myocardial Disease," *Med. Psicosomatica (Rome),* 11 (1966), 1-30.

----. "Correlated Cardiovascular Adrenergic and Adrenocortical Responses to Sensory and Mental Annoyances in Man: A Potential Accessory Cardiac Risk Factor," *Psychosom. Med.,* 30 (1968), 809-818.

Rees, W. D. and S. G. Lutkins. "Mortality of Bereavement," *Br. Med. J.,* 4 (1967), 13-16.

Reiser, M. F. "Theoretical Considerations of the Role of Psychological Factors in Pathogenesis and

Etiology of Essential Hypertension," *Bibl. Psychiatr.,* 144 (1970), 117-124.

Reiser, M. F., A. A. Brust, and E. Ferris. "Life Situations, Emotions and the Course of Patients with Arterial Hypertension," *Psychosom. Med.,* 13 (1951), 133-139,

Reiser, M. F., R. B. Reeves, and J. Armington. "The Effect of Variations in Laboratory Procedure and Experimenter upon the Ballistocardiogram, Heart Rate, and Blood Pressure of Healthy Young Men," *Psychosom. Med.,* 17 (1955), 185-199.

Reiser, M. F., M. Rosenbaum, and E. B. Ferris. "Psychologic Mechanisms in Malignant Hypertension," *Psychosom. Med.,* 13 (1951), 147-159.

Reiser, M. F., M. Thaler, and H. Weiner. "The Experimental Manipulation of Projective Stimuli in the Study of Psychophysiological Responses," *Psychosom. Med.,* 17 (1955), 480.

Reiser, M. F., H. Weiner, and M. Thaler. "Patterns of Object Relationships and Cardiovascular Responsiveness in Healthy Young Adults and Patients with Peptic Ulcer and Hypertension," *Psychosom. Med.,* 19 (1957), 498.

Rennie, T. A. "Personality in Hypertensive States," *N. Engl. J. Med.,* 221 (1939), 448-456.

Rifkin, B. F. "The Treatment of Cardiac Neurosis Using Systematic Desensitization," *Behav. Res. Ther.,* 6 (1968), 239-241.

Riseman, J. E. F. "Management after the Acute Coronary Attack," *Vase. Dis.,* 3 (1966), 315-319.

Rodda, B. E., M. C. Miller, 3RD, and J. G. Bruhn. "Prediction of Anxiety and Depression Patterns among Coronary Patients Using a Markov Process Analysis," *Behav. Set.,* 16 (1971), 482-489.

Rosen, J. L. and G. J. Bibring. "Psychological Reactions of Hospitalized Male Patients to Heart Attacks," *Psychosom. Med.,* 28 (1966), 808-821.

Rosenberg, S. G. "Patient Education Leads to Better Care for Heart Patients," *HSMHA Health Rep.,* 86 (1971), 793-802.

Rosenman, R. H. and M. Friedman. "The Central Nervous System and Coronary Heart Disease," *Hosp. Practice,* 5 (1971), 87-97.

Rosenman, R. H., M. Friedman, and S. O. Byers. "Glucose Metabolism in Subjects with Behavior Pattern A and Hyperlipemia," *Circulation,* 33 (1966), 704-707.

Rosenman, R. H., M. Friedman, C. D. Jenkins et al. "The Prediction of Immunity to Coronary Heart Disease," *JAMA,* 198 (1966), 137-140.

Sachdev, N. S., C. C. Carter, R. L. Swank et al. "Relationship between Post-Cardiotomy Delirium, Clinical Neurological Changes and EEG Abnormalities," *J. Thorac. Cardiovasc. Surg.,* 54 (1967), 557-563.

Sapira, J. D., E. T. Scheilp, R. Moriarty et al. "Differences in Perception between Hypertensive and Normotensive Populations," *Psychosom. Med.,* 33 (1971), 239-250.

Saslow, G., G. C. Gressel, F. O. Shobe et al. "Possible Etiologic Relevance of Personality Factors in Arterial Hypertension," *Psychosom. Med.,* 12 (1950), 292-302.

Saul, L. J. "Hostility in Cases of Essential Hypertension," *Psychosom. Med.,* 1 (1939), 153-161.

Saul, L. J., E. Sheppard, D. Selby et al. "The Quantification of Hostility in Dreams with Reference to Essential Hypertension," *Science,* 119 (1954),382-383.

Schacter, J. "Pain, Fear, and Anger in Hypertensives and Normotensives," *Psychosom. Med.,* 19 (1957), 17-29.

Schneider, D. E. *The Image of the Heart*. New York: International Universities Press, 1956.

Schneider, R. A. and V. M. Zangari. "Variations in Clotting Time, Relative Viscosity and other Physiochemical Properties of the Blood Accompanying Physical and Emotional Stress in the Normotensive and Hypertensive Subject," *Psychosom. Med.,* 13 (1951), 289-303.

Schottstaedt, W. W., W. J. Grace, and G. Wolff. "Life Situations, Behaviour, Attitudes, Emotions, and Renal Excretion of Fluid and Electrolytes, I-V," *J. Psychosom. Res.,* 1 (1956), 75-83.

Schull, W. J., E. Harburg, J. C. Erfurt et al. "A Family Set Method for Estimating Heredity and Stress: II. Preliminary Results of the Genetic Methodology in a Pilot Survey of Negro Blood Pressure, Detroit, 1966, 1967," *J. Chronic Dis.,* 23 (1970), 83-92.

Scotch, N. A. and H. J. Geiger. "The Epidemiology of Essential Hypertension. II. Psychological and Sociocultural Factors in Etiology," *J. Chronic Dis.,* 16 (1963), 1183-1213.

Selye, H. *The Stress of Life,* pp. 128-148. New York: McGraw-Hill, 1956.

Shapiro, A. P. "Psychophysiologic Pressor Mechanisms and Their Role in Therapy," *Mod. Treat.,* 3 (1966), 108-117.

Shapiro, A. P., M. Rosenbaum, and E. B. Ferris. "Relationship Therapy in Essential Hypertension," *Psychosom. Med.,* 13 (1951). 140-146.

Shapiro, D., B. Tursky, E. Gershon et al. "Effects of Feedback and Reinforcement on the Control of Human Systolic Blood Pressure," *Science,* 163 (1969), 588-590.

Shapiro, D., B. Tursky, and G. E. Schwartz. "Control of Blood Pressure in Man by Operant Conditioning," *Circ. Res.,* 27, *Suppl.* 1 (1970), 27-41.

Shekelle, R. B., A. M. Ostfeld, B. Z. Lebovits et al. "Personality Traits and Coronary Heart Disease: A Re-examination of Ibrahim's Hypothesis Using Longitudinal Data," *J. Chronic Dis.,* 23 (1970), 33-38.

Shekelle, R. B., A. M. Ostfeld, and O. Paul. "Social Status and Incidence of Coronary Heart Disease," *J. Chronic Dis.,* 22 (1969). 381-394.

Silverman, A. J., S. I. Cohen, and G. D. Zuidiman. "Psychophysiological Investigations in Cardiovascular Stress," *Am. J. Psychiatry,* 113 (1957), 691-693.

Silverstone, S. and B. Kissin. "Field Dependence in Essential Hypertension and Peptic Ulcer," *J. Psychosom. Res.,* 12 (1968), 157-161.

Silverstone, J. T., M. M. Tannahill, and J. A. Ireland. "Psychiatric Aspects of Profound Hypothermia in Open-Heart Surgery," *J. Thorac. Cardiovasc. Surg.,* 59 (1970), 193-200.

Sjoerdsma, A. “Relationships between Alterations in Amine Metabolism and Blood Pressure,” Society of Actuaries. The Build and Blood Pressure Study, 1959. *Circ. Res.,* 9 (1961), 734-745.

Sokolow, M. and D. Perloff. “The Choice of Drugs and the Management of Essential Hypertension,” *Prog. Cardiovasc. Dis.,* 8 (1965), 253-277.

Sokolow, M., D. Werdegar, D. B. Perloff et al. “Preliminary Studies Relating Portably Recorded Blood Pressures to Daily Life Events in Patients with Essential Hypertension,” *Bibl. Psychiatr.,* 144 (1970), 164-189.

Stamler, J. “Cigarette Smoking and Atherosclerotic Coronary Heart Disease,” *Bull. N.Y. Acad. Med.,* 44 (1968), 1476-1494.

----. The Primary Prevention of Coronary Heart Disease,” *Hosp. Practice,* 6 (1971), 49-61.

Stead, E. A., Jr., J. V. Warren, A. J. Merrill et al. “Cardiac Output in Male Subjects as Measured by Technique of Right Atrial Catheterization. Normal Values with Observations on the Effect of Anxiety and Tilting,” *J. Clin. Invest.,* 24 (1945). 326-331.

Stevenson, I. P., C. H. Duncan, and H. G. Wolff. “Circulatory Dynamics before and after Exercise in Subjects With and Without Structural Heart Disease during Anxiety and Relaxation,” *J. Clin. Invest.,* 28 (1949), 1534-1543.

Stonehill, E. “The Role of Denial in Incurable Disease: Psychological Adaptation to Long-term Cardiac Pacemakers,” *Bibl. Psychiatr.,* 144 (1970), 151-163.

Storment, C. T. “Personality and Heart Disease,” *Psychosom. Med*., 13 (1951), 304-313.

Syme, S. L. “Psychological Factors and Coronary Heart Disease,” *Int. J. Psychiatry,* 5 (1968), 429-433.

Thaler, M., H. Weiner, and M. F. Reiser. “Exploration of the Doctor—Patient Relationship through Projective Techniques. Their Use in Psychosomatic Illness,” *Psychosom. Med.,* 19 (1957), 228-239.

Thomas, C. B. "Observations on Some Possible Precursors of Essential Hypertension and Coronary Artery Disease," *Bull. Johns Hopkins Hosp.,* 89 (1951), 419-441.

----. "Characteristics of the Individual as Guideposts to the Prevention of Heart Disease," *Ann. Intern. Med.,* 47 (1957), 389-401.

----. "Characteristics of Smokers Compared with Nonsmokers in a Population of Healthy Young Adults, Including Observations on Family History, Blood Pressure, Heart Rate, Body Weight, Cholesterol and Certain Psychologic Traits," *Ann. Intern. Med.,* 53 (1960), 697-718.

----. "The Precursors of Hypertension," *Med. Clin. North Am.,* 45 (1961), 259.

----. "Psychophysiologic Aspects of Blood Pressure Regulation: The Clinician's View," *Psychosom. Med.,* 26 (1964), 454-461.

----. "Psychophysiological Aspects of Blood Pressure Regulation: A Clinician's View," *J. Chronic Dis.,* 17 (1964), 599-607.

----. "The Precursors of Hypertension and Coronary Artery Disease: Insights from Studies of Biological Variation," *Ann. N.Y. Acad, of Sci.,* 134 (1966), 1028-1040.

----. "Developmental Patterns in Hypertensive Cardiovascular Disease: Fact or Fiction?" *Bull. N.Y. Acad, of Med.,* 45 (1969), 831-850.

Thomas, C. B. and B. H. Cohen. "The Familial Occurrence of Hypertension and Coronary Artery Disease with Observations Concerning Obesity and Diabetes," *Ann. Intern. Med.,* 42 (1955), 90-126.

Thurston, J. G. B. "A Controlled Trial of Hyperbaric Oxygen in Acute Myocardial Infarction—Preliminary Results," *Am. Heart Assoc. (Abstract in circulation),* 40 *Suppl.* 3 (1969), 203.

Trowill, J. A. "Instrumental Conditioning of the Heart Rate in the Curarized Rat," *J. Compr. Physiol. Psychol.,* 63 (1967), 7-11.

Tufo, H. M., A. M. Ostfeld, and R. Shekelle. “Central Nervous System Dysfunctioning following Open-Heart Surgery,” *J. Am. Heart Assoc.,* 212 (1970), 1333-1340.

Vanderhoof, E., J. Clancy, and R. S. Engelhart. “Relationship of a Physiological Variable to Psychiatric Diagnoses and Personality Characteristics,” *Dis. Nerv. Syst.,* 27 (1966), 171-177.

Van der Valk, J. M. “Blood-Pressure Changes under Emotional Influences in Patients with Essential Hypertension and Control Subjects,” *J. Psychosom. Res.,* 2 (1957). 134-144.

Van der Valk, J. M., and J. J. Groen. “Personality Structure and Conflict Situation in Patients with Myocardial Infarction,” *J. Psychosom. Res.,* 11 (1967), 41-46.

von Eiff, A. W. “The Role of the Autonomic Nervous System in the Etiology and Pathogenesis of Essential Hypertension,” *Jap. Circ. J.,* 34 (1970), 147-153.

Voors, A. W. “Lithium in the Drinking Water and Atherosclerotic Heart Death: Epidemiologic Argument for Protective Effect,” *Am. J. Epidemiol.,* 92 (1970), 164-171.

Vreeland, R. and G. L. Ellis. “Stresses on the Nurse in an Intensive Care Unit,” *JAMA*, 208 (1969), 332-334.

Walter, P. F., S. D. Reid, and N. K. Wenger. “Transient Cerebral Ischemia Due to Arrhythmia,” *Ann. Intern. Med.,* 72 (1970), 471-473.

Weinberger, M. H., R. D. Collins, A. J. Dowdy et al. “Hypertension Induced by Oral Contraceptives Containing Estrogen and Gestragen,” *Ann. Intern. Med.,* 71 (1969). 891-902.

Weiner, H., M. T. Singer, and M. F. Reiser. “Cardiovascular Responses and Their Psychological Correlates. I. A Study in Healthy Young Adults and Patients with Peptic Ulcer and Hypertension,” *Psychosom. Med.,* 24 (1962), 477-498.

Weiss, B. “Electrocardiographic Indices of Emotional Stress,” *Am. J. Psychiatry,* 113 (1956), 348-351.

Weiss, T. and B. F. Engel. “Operant Conditioning of Heart Rate in Patients with Premature

Ventricular Contractions," *Psychosom. Med.,* 33 (1971), 301-321.

Wells, R. L. "The 'Unemployable' Cardiac Patient," *JAMA*, 218 (1971), 247.

Wendkos, M. H. "The Influence of Autonomic Imbalance on the Human Electrocardiogram. I. Unstable T-Waves in Precordial Leads from Emotionally Unstable Persons without Organic Heart Disease," *Am. Heart J.,* 28 (1944), 549-567.

Wendkos, M. H. and R. Logue. "Unstable T-Waves in Leads II and III in Persons with Neurocirculatory Asthenia," *Am. Heart J.,* 31 (1946), 711-723.

Werko, L. "Can We Prevent Heart Disease? Multifactorial Physical, Environmental, Hereditary, Clinical Factors Are Identified," *Ann. Intern. Med.,* 74 (1971), 278-288.

White, K. "Angina Pectoris and Angina Innocens," *Psychosom. Med.,* 17 (1955), 128-138.

Williams, R. B., Jr., C. P. Kimball, and N. Willard. "The Influence of Interpersonal Interaction Upon Diastolic Blood Pressure," *Psychosom. Med.,* 32 (1972), 194-198.

Williams, R. B., Jr., and F. P. McKegney. "Psychologic Aspects of Hypertension. I. The Influence of Experimental Interview Variables on Blood Pressure," *Yale J. Biol. Med.,* 38 (1965), 265-273.

Williamson, J., J. Mitchell, S. Kreider et al. "Assessing End Results for Heart Failure Patients Selected from a Coronary Care Unit," Am. Fed. Clin. Res. Natl. Meet., May 1968, Abstract. *Clin. Res.,* 16 (1968), 367.

Wincott, E. A. and F. I. Caird. "Return to Work after Myocardial Infarction," *Br. Med. J.,* 2 (1966), 1302-1304.

Wishnie, H. A., T. P. Hackett, and N. H. Cassem. "Psychological Hazards following Coronary Infarct," *JAMA,* 215 (1971), 1292-1296.

Wolf, G. A. and H. G. Wolff. "Studies on the Nature of Certain Symptoms Associated with Cardiovascular Disorders," *Psychosom. Med.,* 8 (1946), 293-319.

Wolf, S. “Psychosocial Forces in Myocardial Infarction and Sudden Death,” *Circulation,* 39, *Suppl.* 4 (1969), 74-83.

Wolf, S., P. V. Cardon, Jr., E. M. Shepard et al. *Life Stress and Essential Hypertension: A Study of Circulatory Adjustment in Men.* Baltimore: Williams & Wilkins, 1955.

Wolf, S., J. B. Pfeiffer, H. S. Fipley et al. “Hypertension as a Reaction Pattern to Stress: Summary of Experimental Data in Variations in Blood Pressure and Renal Blood Flow,” *Ann. Intern. Med.,* 29 (1948), 1056-1076.

Wolf, S. and E. Shepard. “An Appraisal of Factors that Evoke and Modify the Hypertensive Reaction Pattern,” *Assoc. Res. Nerv. Ment. Dis. Proc.,* 29 (1950), 976-984.

Wolff, F. W. and R. D. Lindeman. “Effects of Treatment in Hypertension. Results of a Controlled Study,” *J. Chronic Dis.,* 19 (1966), 227-240.

Wolff, H. G. “Life Stress and Cardiovascular Disorders,” *Circulation,* 1 (1949), 187-203.

Wolff, K. “Angina Pectoris and Emotional Disturbances,” *Dis. New. Syst.,* 30 (1969), 401-404.

Wolpe, J. *Psychotherapy by Reciprocal Inhibition,* pp. 139-165. Stanford: Stanford University Press, 1958.

Yamori, Y., W. Lovenberg, and A. Sjoerdsma. “Norepinephrine Metabolism in Brainstem of Spontaneously Hypertensive Rats,” *Science,* 170 (1970), 544-546.

Ziskind, E. and T. Augsburg. “Hallucinations in Sensory Deprivation,” *Dis. Nerv. Syst.,* 28 (1967), 721-726.

Notes

1This chapter has a subsection on Psychophysiological and Psychodynamic Problems of the Patient with Structural Heart Disease by Morton F. Reiser and Hyman Bakst.

2This section through is modified from the corresponding section in Chapter 33, Psychology of Cardiovascular Disorders by Morton F. Reiser and Hyman Bakst, appearing in the 1st ed.

of the American Handbook of Psychiatry, Vol. 1, New York: Basic Books, 1959.