Stress Management in Occupational Settings

GARY E. SCHWARTZ, PhD

SUBSTANTIAL PROGRESS in documenting the role of psychosocial stress in the etiology and development of physical and mental disease has been made in the past 10 years. It is now known that not only are the classic psychosomatic disorders—such as hypertension, ulcers and asthma—strongly influenced by psychosocial stress, but even susceptibility to and recovery from infectious and genetic disorders (ranging from the common cold to cancer) are determined, at least in part, by stress in the environment and the person's way of coping with stress (*1,2*).

Also in the past decade, substantial progress has been made in documenting effective behavioral approaches to the management of psychological and physiological responses to stress. We now know that various behavioral techniques including relaxation, meditation, biofeedback, and other psychological self-control procedures, can be helpful in treating some persons with mental and physical disorders (*3*). These behavioral techniques, when integrated, within a comprehensive, biobehavioral approach to health and illness, can also (*a*) enhance the effectiveness of biomedical treatments such as drugs and, in the process, reduce the dosage needed to produce a given clinical effect and (*b*) decrease susceptibility to future disease by promoting positive approaches to health. In other words, stress management procedures are not only useful in treatment, but they also may be useful in the prevention of illness.

It should be recognized at the outset that most of the research conducted to date that links stress to illness is not based on data derived from occupational settings. Although a growing body of literature specifically documents the effects of occupational stress in the etiology and development of physical and mental disease (*4,5*), data that directly test the effects of stress management procedures in the treatment and prevention of stress-related disorders in occupational settings are scarce (*6*). The relative lack of data in this area is neither surprising nor discouraging, because it is only recently that basic and clinical research on stress has developed to the point of seriously justifying research and applications in occupational settings. Furthermore, industry just recently became aware of (*a*)

Dr. Schwartz is a professor in the Department of Psychology, Yale University and the Department of Psychiatry, Yale University School of Medicine, New Haven, Conn.

This article is adapted from a background paper prepared for the National Conference on Health Promotion Programs in Occupational Settings; it was supported by contract No. 282–78–0174 with the Office of Health Information, Health Promotion and Physical Fitness and Sports Medicine, Public Health Service.

Tearsheet requests to Dr. Gary E. Schwartz, Department of Psychology, Box 11A, Yale Station, Yale University, New Haven, Conn. 06520.

its role in promoting and sustaining health and (*b*) the potential benefits that may accrue by industry, labor, and science working together to promote health in occupational settings.

The challenge facing industry, labor, and science today is to design stress management programs that can be clinically and cost effective and then to carefully evaluate these programs in occupational settings through systematic research. The promise of positive results emerging from collaborative research in this area is substantial and should be pursued vigorously, despite the numerous problems in conducting such research.

We are witnessing today a major change in our conception of health and illness. In the past, psychological and biological models of health and illness were couched in separate scientific languages and practiced by separate disciplines—now these separations are being broken down. Behavioral and biomedical sciences are beginning to join forces to tackle health problems that require a multidisciplinary approach to their solution. The concept of stress and its implications for health and illness is a key factor bringing these disparate disciplines together.

The extent of this change in orientation can be seen, for example, in the emergence of the new field of behavioral medicine. Formally established at the Yale Conference on Behavioral Medicine in February 1977 (*7*) and extended at a meeting hosted by the Institute of Medicine of the National Academy of Sciences in April 1978, which founded the Academy of Behavioral Medicine Research, Behavioral Medicine has been defined as follows (*8,8a*):

> Behavioral Medicine is the interdisciplinary field concerned with the development and integration of behavioral and biomedical science, knowledge, and techniques relevant to health and illness and the application of this knowledge and these techniques to prevention, diagnosis, treatment and rehabilitation.

Two words in this definition, development and integration, need to be emphasized, because they highlight the pitfalls and promise of stress management as applied to health and illness in occupational settings. Although the present data are encouraging, many key basic and applied questions still need to be answered. The development of this knowledge will hinge on the creative integration of behavioral and biomedical approaches. When applied to the occupational setting, the development of this knowledge will further hinge on the integration and collaboration of industry, labor, and science. As Neal Miller, PhD, one of the pioneers of behavioral approaches to health and illness, said concerning behavioral medicine's future, we must be "bold in what we try, but cautious in what we claim." In this spirit, I will review what is and what is not known about stress management in occupational settings, suggest some of the directions to be considered for future research and applications, and indicate the cautions that must be considered in light of our present state of knowledge.

The "Models Linking Stress to Illness" are presented on pages 106–107 for those who are not familiar with the psychobiology of stress and illness.

The literature linking occupational stress to disease is reviewed in a 1974 volume (*4*) and in the proceedings of a 1977 conference sponsored by NIOSH (*5*). Some of the major classes of psychosocial stress facing workers have been summarized recently by James S. J. Manuso, PhD, director, Emotional Health Program, Equitable Life Assurance Society:

1. Work overload, or work stagnation
2. Extreme ambiguity, or rigidity in relation to one's tasks
3. Extreme role conflict, or little conflict
4. Extreme amounts of responsibility (especially for other people), or little responsibility
5. Cut-throat and negative competition (or one-upmanship), or no competition
6. Constant change and daily variability, or a deadening routinized stability
7. Ongoing contact with "stress carriers" (e.g. demanding workaholics, highly anxious people, indecisive individuals), or social isolation
8. That the corporation, for its own survival, encourages its employees to define their egos in terms of the organization, to contain emotional reactions, and to depend upon it, and
9. The interaction of one's stage of career development, career opportunity, and management style.

According to Manuso, "It is not surprising, then, that 58% of the men and 36% of the women in a sample of 95 Emotional Health Program participants at the Equitable Life Assurance Corporation stated that job-related factors, at least in part caused or contributed to their problems."

A recent paper by Chesney and Feuerstein (*9*) highlights some important research on sources of stress. For example, using a homogeneous population of 1,540 white-collar workers (84 percent male) in a large financial institution, Weiman (*10*) examined Selye's (*11*) hypothesis that both overstimulation and understimulation are sources of stress and are associated with a higher level of disease or risk. Weiman confirmed this hypothesis, observing a U-shaped relationship between stimulation (measurement by an index of workload, role conflict, task ambiguity, and responsibility) and an

index of disease or risk (including smoking, hypertriglyceridemia, hypercholesterolemia, atherosclerotic heart disease, essential hypertension, exogenous obesity, and peptic ulcer). It is of considerable interest that both over- and under-stimulation can result in an increase in stress-related disorders and behaviors associated with health risk. Chesney and Feuerstein (*9*) comment that research on the health of occupational groups whose jobs are characterized by understimulation, such as blue-collar assembly workers, would further establish this important U-shaped relationship between environment and disease.

Zorn and co-workers (*12*), in a study of West German sea pilots, observed excess cardiac mortality in this occupational group compared to the cardiac death rate of the male population of Hamburg. Although numerous studies report a relationship between stress and heart disease, the mechanisms linking these two factors remain unknown. To explore the hypothesis that increased catecholamine levels contribute to the relationship between job stress and cardiac death, Zorn and co-workers measured urinary catecholamines in five sea pilots before, immediately after, and 24 hours after a stressful river piloting operation. They found a significant elevation in catecholamines between the pre- and post-trip collections and a subsequent drop in catecholamines 24 hours after the operation.

A related study linking catecholamines and job stress was recently conducted by Dutton and co-workers (*13*) who compared a group of paramedics with a group of firefighters. Although both groups had similar scores on the Schedule of Recent Life Events—a general life stress scale that predicts susceptibility to disease (*14*)—the paramedics scored significantly higher than the firefighters on a job stress questionnaire designed specifically for the study. The paramedics, importantly, also had significantly higher levels of epinephrine and norepinephrine on work days than on nonwork days.

Chesney and Feuerstein (*9*) recognized that although these studies suggest an association between environmental stress and disease, certain cognitive, personality, and behavior characteristics of the employee (mediated by the brain) interact with characteristics of the environment and influence this association. In collaboration with Chadwick (*15*), they attempted to define the relationships between job and life stresses, personality characteristics and behavior patterns, job and home environments, physiological strain variables, and coronary heart disease risk and status; they assessed these variables over a 1½-year period for 397 men who were examined at their worksites. The data indicate, for example, that higher levels of catecholamines correlated with job stress as measured by the work pressure subscale of the Work Environment Scale (*16*) and impulsiveness as measured by the Eysenck Personality Inventory (*17*). Although not mentioned in their report, the implication is that persons high in job stress and high in impulsiveness will more likely evidence health risk factors than persons high in either one alone. As discussed in the "Models Linking Stress to Illness" the need for multimeasure, interactive analyses is critical if the effects of job stress on health are to be understood and therefore controlled.

It must be recognized that combinations of factors within and outside the work situation interact and contribute to disease. Because the work setting may be either a primary determinant of risk, or it may interact with serious stresses in the worker's personal life, the study of the relationship between job stress and illness is complicated. On the other hand, the control role that the work situation plays in people's lives increases the potential impact that industry can have in motivating persons to change their lifestyles for the sake of their health. Industry may, for its own purposes, wish to reduce absenteeism, enhance productivity, and reduce insurance and medical costs. However, providing stress management training as part of a more comprehensive health enhancement program may not only help the worker in the work situation, but also may help the worker to deal with significant problems occurring outside the work situation. In this way, industry can potentially make a greater contribution to society at large.

Introduction to Stress Management Procedures

Numerous procedures are documented by research that can influence response to stress. Some procedures are geared toward helping people change their environment to be more healthful. For example, various studies document how assertiveness training can be used to help people take better control of their lives and in the process reduce tension and hence decrease the physiological responses of strain due to excessive anger or anxiety, or both (*18*). The goal of assertiveness training programs is not to make people more aggressive, but rather to help them to assert themselves more appropriately in order to reduce the likelihood that they will engage in health risk behaviors reinforced by peer pressure, or to help them modify their jobs (through appropriate channels) to be more healthful. Often, assertiveness training programs consist of combinations of behavior therapy, imagery, role playing, and other techniques aimed at improving people's ability to communicate their concerns, which helps them change

the groups in which they work—not only to better meet their individual needs, but also to improve the functioning of the group as a whole.

Other stress management procedures are geared toward helping people cope with an environment that cannot be changed. These coping procedures involve various mental and psychophysiological techniques including relaxation, meditation, biofeedback, and guided imagery. For example, progressive relaxation involves teaching people to tense and relax each of the major muscle groups of the body—a "somatic" procedure (*19*), while autogenic training involves teaching people to imagine particular sensations—such as one's limbs being warm and heavy—a "cognitive" procedure—with the goal of reducing autonomic arousal (*20*).

Other techniques combine various mental and somatic relaxation procedures. The most well known of these procedures was developed by Benson (*21*), who proposes that the harmful effects of prolonged psychosocial stress are mediated by excessive elicitation of a hypothalamically controlled "fight or flight" response, with its attendant increased sympathetic nervous activity. Benson further proposes that a reaction opposite in its physiological effects to those of the "fight or flight" response is an integrated "relaxation response" also mediated by the hypothalamus. The relaxation response is presumably elicited by a variety of relaxation and meditation techniques. Goleman and Schwartz (*22*) also have documented the effectiveness of relaxation response procedures.

Benson's technique draws on a combination of processes to promote the relaxation response. It includes (*a*) relaxation of all skeletal muscles, (*b*) attention to breathing in a relaxed fashion, (*c*) saying a simple word ("one") after each breath (to help remove distracting thoughts), and (*d*) adopting a passive attitude (thereby further removing the requirement to respond to one's own images). It should be noted that this simple technique, which can be taught by any trained health professional or paraprofessional in a single session and can be supported by simple cassette tape instructions and reading materials, actually combines mental and skeletal muscle relaxation, as well as expectancy and "placebo" effects.

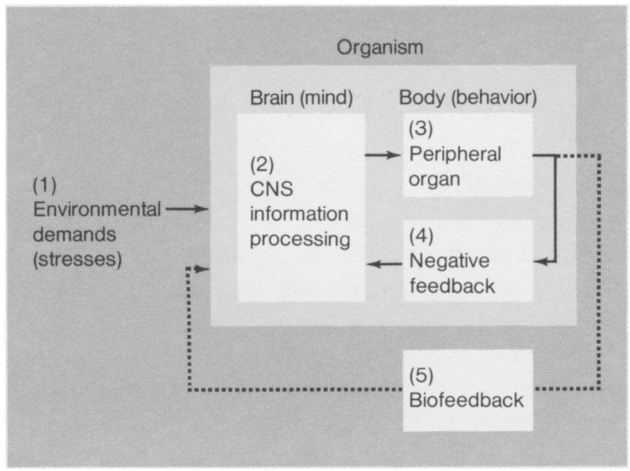
Carrington (*23*) proposes a similar procedure in terms of the basic component processes. However, her procedure differs from Benson's in a number of important respects. Whereas Benson recommends that people practice his technique 15 to 20 minutes in the morning and evening, Carrington recommends that people practice on a more ad lib basis, and, ideally, they should practice in actual stressful situations. In addition, Carrington encourages persons to select their own "mantras" so as to make the procedure more personally relevant and pleasant. Carrington claims that these changes, plus others, lead to increased adherence. However, there are currently no published studies that carefully compare the different relaxation procedures in terms of their actual clinical efficacy and long-term adherence.

Biofeedback has evolved over the past 10 years as a means of teaching specific voluntary control over particular muscles or visceral responses (*24*). As shown in the diagram, biofeedback can be seen as the use of electronic sensors to make normally unconscious physiological feedback processes conscious, and thereby increase the capacity of the person to exercise self-control. Whether biofeedback training procedures substantially augment the effectiveness of various relaxation procedures used by themselves is controversial (*25*). It is likely that biofeedback training is, per se, not essential for many patients with stress-related problems. However, research does suggest that biofeedback is important as an adjunct to stress management procedures for at least two major reasons:

1. It helps convince the patient that he can actually voluntarily control his physiological responses, and that psychosocial stress does, in fact, elicit stress responding.

2. It provides reinforcement for the patient and therapist regarding the patient's progress over time.

Simplified block diagram depicting (1) environmental demands influencing (via exteroceptors, not shown), (2) the brain's regulation of its (3) peripheral organs, and (4) negative feedback from the periphery back to the brain. Disregulation can be initiated at each of these stages. Biofeedback (stage 5) is a parallel feedback loop to stage 4, detecting the activity of the peripheral organ (stage 3) and converting it into environmental demands (stage 1) that can be used by the brain (stage 2) to increase self-regulation (reference 33).



It allows both patient and therapist to discover what relaxation procedure (or combination of stress management procedures) is or is not effective in reducing the physiological symptoms of stress responding. As Schwartz (*26*) emphasizes in this context, biofeedback should not be used simply as a self-regulation training technique, but rather as a clinical "research" tool essential to effective and responsible clinical practice.

Various mental self-control procedures have been devised for helping patients decrease stress responding. In addition to systematic desensitization, where anxiety provoking imagery is coupled with deep muscle relaxation to reduce stress, specific stress "inoculation" programs have been developed for helping people cope with pain and distress (*27*). For example, Turk used an experiment pain task to document that stress inoculation training (consisting of imagery-rehearsal role playing, and specific mental self-statements) resulted in a 100 percent increase in subject's ability to endure the pain, whereas morphine alone led to only a 30 to 60 percent increase in subject's ability to endure the pain (*28*). It should also be noted that hypnosis and various other suggestion procedures are sometimes used to further enhance such effects.

It is generally accepted that specific combinations of stress management techniques can help certain people reduce their response to stress, and that these effects are not due to simple expectancy or "placebo" factors. However, the research has not advanced to the point that enables clinicians to predict with any precision what kind of person, with what kinds of problems, will respond best to what combinations of procedures. Furthermore, little research has been conducted to date that has combined, for example, relaxation training with assertiveness training with the explicit goal of changing the person and the environment in a balanced fashion.

However, most significant for this paper is that at present, only one published study systematically evaluated the use of a stress management technique in a work setting (*29,30*). However, a few additional studies have been either completed but not published, or they are in progress. A review of these studies follows.

Clinical Aspects of Stress Management

Benson and colleagues recently published a major study comparing the effects of daily "relaxation breaks" on five self-reported measures of health, performance and well being (*29*) and measures of systolic and diastolic blood pressure and heart rate (*30*). The work was done at the Converse Rubber Company, a subsidiary of the Eltra Corporation. For 12 weeks, 126 volunteers filled out daily records and reported for biweekly blood pressure measures. After 4 weeks of baseline monitoring, they were divided randomly into three groups: Group A was taught Benson's technique for producing the relaxation response, group B was instructed to sit quietly and relax any way they wanted, and group C received no instructions. Groups A and B were asked to take two 15-minute relaxation breaks daily.

After an 8-week experimental period, the greatest mean improvements on every index occurred in group A, the least improvements occurred in group C, and group B was intermediate. Differences between the mean changes in group A versus group C reached statistical significance ($P < .05$) on four of the five indices: symptoms, illness days, performance, and sociability-satisfaction. The relationship between amount of change and rate of practicing the relaxation response was different for the various indices. Although fewer than three practice periods per week produced little change on any index, two daily sessions appeared to be more than necessary for many persons to achieve positive changes. Interestingly, somatic symptoms and performance responded with less practice of the relaxation response than did behavioral symptoms and measures of well being.

The results for blood pressure paralleled the self-report measures. Although the subjects generally were normotensive, the decreases in systolic blood pressure from the beginning to the end of the study were −11.6 mm Hg for group A, −6.5 mm Hg for group B, and +0.4 mm Hg for group C; mean diastolic blood pressures decreased by −7.9, −3.1, and −0.3. Moreover, within group A, the higher the initial blood pressure, the greater the decrease with relaxation training.

An interesting, serendipitous finding occurred for the blood pressure data. Both systolic and diastolic blood pressures rose in all three groups for session 6 and fell again for session 7 in groups A and B but not group C. The project was apparently initiated shortly before the company experienced the effects of a nationwide economic recession. As a result, the company initiated a series of layoffs, most of which were implemented on three consecutive Fridays, beginning at session 5 and ending at session 6. Although only 5 percent of the total corporate staff were laid off, another 10 percent were offered and accepted other positions in the company. During sessions 5 and 6, many participants mentioned their anxiety about their job security or increased workload or their concern for colleagues who had been forced to move or leave. Benson and co-workers (*30*)

hypothesized that stress mounted over those weeks, and blood pressure increased accordingly. Other investigators (*31*) have reported such increases in blood pressure during the anticipation phase of factory shutdowns among employees who eventually lost their jobs. Benson and co-workers (*30*) also offered the intriguing hypothesis that blood pressures may have returned to the original levels more rapidly in groups A and B than in C (session 7) due to some effect of the relaxation practice.

The preceding data are clearly encouraging and beg to be replicated and extended under more controlled conditions. Benson and co-workers (*30*) pointed out some of the limitations of their experiment, including the lack of control for positive expectancy effects, the lack of followup data, the lack of actual data regarding subsequent use of health services, and so forth. Furthermore, their study was not performed on patients who were seeking help for specific stress-related disorders. On the other hand, the data illustrate the potential of incorporating a relatively simple relaxation procedure into an industrial setting which could have beneficial effects on health and work performance. Benson and co-workers noted that if the relaxation response proves capable of maintaining lowered blood pressure in normotensive subjects, "it might become a most useful component of preventive as well as therapeutic programs."

Regarding cost, Benson and co-workers commented:

> The relaxation response is particularly attractive as a preventive measure since it costs only the time involved to practice, has no known side effects, and is reported to be a pleasant and personally rewarding experience by those who elicit it regularly.

However, precise cost-benefit ratios have not been computed.

In Benson's studies cited, the relaxation training was purely voluntary. The company did not reinforce the employees for learning stress management by giving them, for example, time off from work to learn and practice the skills. However, an excellent model of a corporation supported, comprehensive approach to stress management was developed by Manuso and colleagues for Equitable Life Assurance Society of the United States. They have established an Emotional Health Program, staffed with a clinical psychologist, a psychiatrically oriented physician, a clinical psychology intern, and a counselor. Liaisons are maintained with outside mental health practitioners, universities, and hospitals. The program is more than just a referral service. It is concerned with the detection, prevention, education, treatment, referral, and followup of troubled employees. All services are free and on company time, along with all other medical services. The Emotional Health Program is physically housed in the Employee Health Services Department, thereby enabling the delivery of multimodality (psychological and medical) services. All services are confidential, ensuring that the workers can freely pursue and therefore, it is hoped, resolve their problems.

Manuso has just completed his first study examining the clinical and cost effectiveness of providing biofeedback and other stress management procedures in the treatment of 15 subjects with headaches and 15 subjects with general anxiety. These subjects held a wide variety of job responsibilities, from filing to upper managerial jobs. Their average annual salary was $14 thousand. The subjects were included in the study if their average symptom activity and their symptom's history met a minimum standard; namely, if symptoms had been present for at least 5 years and if the average symptom activity for a 2-week baseline period (assessed by using a daily log procedure) was "moderate" to "severe." A unique feature of this study was that an additional and different subject population of 30 was used to report on the extent to which significant others at the worksite with stress-related symptoms interfered with the respondent's ability to work. From their percentage estimates, a quantitative effect of interference could be generated. Bosses, closest co-workers, and subordinates were used as significant others at the worksite.

The experiment consisted of 3 phases: the pretreatment baseline phase, during which two no-feedback, electromyographic (EMG) measurement-only sessions were administered; the treatment phase, consisting of 5 weeks of frontalis EMG biofeedback training with 3 sessions per week (the average number of treatment sessions per subject was 13), and the post-treatment followup phase, which consisted of two no-feedback, EMG measurement-only sessions over a 2-week period, taking place 3 months following the last treatment phase session. Subjects were grouped according to primary diagnosis (headache versus anxiety) and served as their own controls.

Numerous before and after measures were taken in this study, including personality scales, health center medical records, daily logs (including medicine used), total interference and work interference due to the presence of symptoms, and so forth. The stress management training included muscle relaxation, breathing exercises, imagery techniques, as well as the biofeed-

back training. Since a complex stress management package was used, it is not possible to attribute the results to any one component or combination of components in the treatment package.

The results were striking because, on the average, improvement occurred in every measure taken. Both groups showed statistically significant decreases in symptoms and increases in work-related satisfaction and effectiveness. Importantly, both anxiety and headache subjects significantly decreased their visits to the health center for both stress-related and other complaints from the period 3 months before treatment (5.75 visits per subject) to 3 months after treatment (1.70 visits per subject). Whereas during the 3 pretreatment months, all subjects had visited the health center because of stress-related symptoms, only five anxiety subjects and two headache subjects visited the health center during the 3 post-treatment months.

These initial results, although striking, must be viewed with caution. There were no control groups in the study. Therefore, one cannot conclude with certainty that similar results would not have been obtained if the subjects had been, for example, placed on drugs (or a "new" drug with potential placebo effects). Furthermore, the followup period is short. On the other hand, only subjects who had longstanding symptoms were selected, and all subjects were currently being seen for traditional biomedical treatment. This argues in favor of the interpretation that sizable decreases in headaches and anxiety observed in these patients were due, at least in part, to the comprehensive stress management program.

Manuso is careful to consider the cost-benefit aspects of this work.

> The estimated average annual pretreatment corporate costs of employing one person with chronic anxiety or headache was found to be $3,394.50. The costs to corporation of an experimental subject-employee are considerable though not patently obvious. The costs involved four factors; namely, visits to the Employee's Health Center ($473.14), time away from the job in order to visit the Health Center ($56.61), work interference due to symptoms ($2,206.95), and meta-interference affecting bosses ($72.80), co-workers ($542.88) and subordinates ($42.12). These costs were present even though subjects were receiving traditional medical treatment, involving diagnosis, prescription of appropriate medications and follow-up by a physician. It will be noted that absenteeism figures are conspicuously absent from this accounting. This is because, on the average, Anxiety and Headache subjects were absent only 4.27 days per year, which is not significantly different from the overall corporate average of 3.92 (two-tail $Z = 1.00$).
>
> The estimated average annual post-treatment corporate costs of employing one person with chronic anxiety or headache were found to amount to $532.68. These costs, when compared to the corresponding pretreatment costs, indicate average savings of $2,861.82 annually per subject. By extrapolation, the expected 3-year savings to the corporation afforded by reduced symptom activity for all 30 subjects would amount to $202,945.05 minus the costs treatment of $24,622.50, which equals $178,322.55. Whereas earlier work (Manuso, 1978) indicated a 1:3 cost-benefit ratio, taking into account a 23% dropout rate, the present research suggests that the ratio averages 1:5.52 for each of the first three years following treatment. This represents a considerable return on investment.

These figures must be viewed as tentative, and they are probably overly optimistic. They do, however, illustrate the potential for stress management programs to have some cost as well as clinical effectiveness. They also point to the need for more comprehensive clinical studies to be conducted in the future.

Suggestions for the Future

With our current knowledge, it is appropriate to consider incorporating various stress management techniques into occupational settings on an experimental basis. Despite the promise of present findings, much needs to be learned through future research that is relevant to industry, labor, and science. Although it is tempting to simply bring some stress management consultants into an industrial setting to conduct a program or two, this approach will not prove valuable in the long run. What is needed are clinical research studies in which relevant health and work variables are measured concurrently, with appropriate short- and long-term evaluation included as a necessary component of the program. Evaluation should not be viewed as necessary only for the initial developmental stages of of such programs. Rather, evaluation (both clinical and cost effectiveness) should be incorporated as a standard component of such programs if future research proves them to be valuable in occupational settings.

Clearly, industry needs to consider how it can promote stress management (as well as health more broadly) by changing its incentive structure. In fact, it may even prove cost effective to reinforce workers to take "relaxation breaks" (*29,30*), which may take a variety of forms (including mental and physical relaxation exercises, plus other recreational-relaxing activities). It may prove cost effective also to change the work setting to better match the needs and physiological limits of the people working in the settings. It is probable that labor will resist simple stress management programs if these programs are offered in the absence of other needed changes in work settings. Requiring the worker to continue to cope with more and more job stress is not a final solution. At some point the strain

will become too great, and everyone (both management and labor) will suffer the consequences. Industry must strive toward reaching a balance between the requirements of the work setting and the worker's capacity to meet those requirements. Industry could make a major contribution to society at large by providing an incentive for health behavior.

As described in the "Models Linking Stress to Illness," stress management should not be isolated. Stress management training can have positive spinoffs, such as reducing drug usage, improving diet, and promoting exercise. Moreover, health programs aimed specifically at changing drug usage (including cigarettes and alcohol), diet, and exercise can have positive spinoffs by helping persons cope with stress. As noted by Benson (*21*), Carrington (*23*), and Meichenbaum (*27*), stress management is a skill useful to any person. The work setting is but one setting, albeit a significant one, where

Models Linking Stress to Illness

Numerous models link stress to illness. Furthermore, confusion and inconsistency exist even in the use of the term stress (*32*). A major source of confusion is whether the term should be used to refer to (*a*) a stimulus in the environment (for example, the loss of one's job), (*b*) the interaction between the person and the environment (for example, how the person perceives the loss of the job), or (*c*) the response of the person (for example increased blood pressure, circulating catecholamines, psychological depression) to the environment. Selye (*11*), who pioneered the concept of the General Adaptation Syndrome, used the term stress to refer to a general stress response of the person, defined stimuli that caused "stress" as "stressors."

In physics and engineering, however, the term stress is used to refer to the stimulus in the environment. The term strain is used to refer to the person's response to stress. By these definitions, stress management would refer only to modify the external stresses, while strain management would refer to actually modifying the person's response to the external stresses.

In this paper, I use the term stress to refer to the environmental stimulus; the term distress to refer to the person's perceived negative reaction to the environmental stresses, and the term stress response (or strain) to refer to the physiological and behavioral consequences of stress. However, I use the term stress management in the broadest sense to refer to changing any aspect of the environment or person that will decrease stress response (strain) and promote health.

The diagram shows a highly simplified but useful means I developed (*33*) for summarizing various models that link stress with illness. Stage 1 (environmental demands) refers to any environmental stress that can potentially place strain on any part of the brain (stage 2) or body (stages 3 and 4). Note that a general stress model of disease includes "simple" physical, chemical, or biological stimuli (temperature, pollutants, or germs), as well as more "complex" psychosocial stimuli such as the demands of being an air traffic controller, as potential stresses that can place strain on the brain or body. A general stress model is useful because it classifies psychosocial stresses as one subgroup of all potential stresses, and therefore views psychological and biological stimuli within a common, biobehavioral framework.

Whereas simple physical-chemical-biological stresses can directly place strain on the body (stages 3 and 4) without necessarily involving the central nervous system (the brain, stage 2), psychosocial stresses operate only on the body (stages 3 and 4) indirectly via the central nervous system (the brain, stage 2). The brain stores all the person's past experiences and therefore modifies the ultimate physiological or behavioral response (stage 3) to the stage 1 environmental demand.

This diagram illustrates, then, an important point regarding the effects of psychosocial stress (stage 1) on the body (stage 3). It follows that strain on the body (stage 3) is always a complex interaction of (*a*) the nature of the environmental stress (stage 1), (*b*) the way the person perceives the stress and reacts to it (stage 2), (*c*) the sensitivity of the body (stage 3) to neural and humoral control from the brain (stage 2), and (*d*) feedback from the body (stage 4) back to the brain regarding the degree of strain on the organs (stage 3) and the brain's (stage 2) response to the feedback.

Genetics, nutrition, diet, exercise, previous disease, and so forth, can influence stages 2–4, and therefore can modify the person's response to a psychosocial stress. Vulnerability to psychosocial stress can be mediated in part by circulating drugs (for example, from cigarettes or coffee), circulating hormones (for example, during the menstrual cycle), and so forth. Nutrition, drugs, diet, and genetics may influence the brain's response to the psychosocial stimuli as well as the organ's sensitivity to neural and humoral responses from the brain. The point to be emphasized is that psychosocial stress (stage 1) never acts on the body (stage 3) in a vacuum, but rather it involves a complex interaction of biological and psychological processes that mediate the stress response.

This analysis of stress is useful for other reasons. It illustrates that there are various mechanisms by which psychosocial stress can increase susceptibility to infectious disease as well as influence healing of all diseases. As originally postulated by Selye (*11*), it is now known that the immune system is modulated, in part, by the brain (stage 2).

such skills are of value. It should also be recognized that stress management need not be viewed only as a means of preventing illness, but also as a means of promoting health. Many of the relaxation and cognitive exercises are inherently pleasant and bring other personal rewards, as does regular exercise.

As noted by Manuso in the unpublished study mentioned earlier, one way that industry may be able to promote the development of stress management programs is to offer predoctoral or postdoctoral fellowships in clinical and health psychology and related disciplines. Most clinical psychologists, for example, do not have experience in occupational settings. To encourage psychologists and other health professionals to apply their skills to problems relevant to occupational settings, a training-incentive program should be established. It should be recognized that developing such internship programs is also cost effective in that

---

If the immune system does not function properly, this will increase a person's susceptibility to all kinds of physical (and genetic) disease, as well as recovery from illness. Using the terminology shown in the diagram, stage 1 psychosocial stresses can, via stage 2, disrupt the immune system in the body (stage 3) such that other stage 1 physical, chemical, or biological stresses can more easily act directly on the body (stage 3) to cause disease.

As more is learned about the central role that the brain plays in the expression of (*a*) psychological processes (*10*) and (*b*) physiological regulation, it becomes clearer how psychosocial factors can play a role in the pathogenesis, treatment, and recovery of all disease. Hence, it is understandable why researchers such as Engel (*34*) are calling for the development of new medical models that take a more integrated, "biopsychosocial" approach to health and illness.

There are numerous other implications of the preceding structural analysis of stress and illness. For example, it becomes clear how psychosocial stresses may modulate the brain in such a way as to lead the person to (*a*) change his or her diet to possibly reduce symptoms of distress (from stage 4), (*b*) take drugs such as alcohol to deaden the experience of distress, (*c*) become depressed, have difficulty sleeping, and therefore not get enough exercise, and so forth. It is well known that psychosocial stress can disrupt healthful behavior, which in turn contributes to disease. In other words, for some individuals, psychosocial stress may be an important mediating factor in their maladaptive behavior. Stress management programs can sometimes have beneficial spinoff effects of reducing people's maladaptive needs for food and drugs, increasing energy, and the desire to exercise, all of which in turn help to promote health.

Another example concerns Cannon's (*35*) concept of homeostasis and its relationship to disease. Cannon argued that the body is designed to maintain physiological levels within certain limits despite demands placed on the body by external physical, chemical, biological, or psychosocial stresses. The diagram illustrates how homeostasis works. Feedback (stage 4) from the body (stage 3) is processed by the brain (stage 2) in such a way as to readjust the regulation of the organ in question (stage 3) so as to maintain certain healthful limits. Much of this self-regulatory system is unconsciousness and appears involuntary. However, symptoms of distress (that is, pain) may emerge from the body (stage 4). The purpose of such pain stimuli is to lead the person (via the brain, stage 2) to (*a*) modify the source of stress in the environment (stage 1), (*b*) leave the environment for the sake of the organ's health (stage 2 leaving stage 1), (*c*) modifying the person's reaction to the external source of the stress (by learning how to relax), (*d*) repair the injured organ (direct modification of stage 3), or (*e*) simply remove the pain per se (achieved by modifying stages 4 or 2 via surgery, drugs, or psychology).

The concept of the need to "treat the cause rather than the symptom" can be restated as the need to modify or eliminate the stress (stage 1) rather than simply eliminate the symptoms of distress (stages 4 or 2). It should be noted that simply repairing the organ (stage 3) leaves the psychosocial stresses intact (stage 1) so that other problems may develop in the future. Furthermore, simply eliminating the distress (via stages 4 and 2) without also affecting the environment (stage 1) results in removing the very mechanism biologically designed to protect organisms from dangerous environments in the first place. Removing these protective feedback loops can, in my terms, be "disregulatory," since it allows psychosocial stresses to increase rather than keeping them in balance (*33*).

I raise these issues to illustrate both the complexity of the problem linking stress to illness as well as the potential for improvement. As more is learned about the role of the brain in mediating responses to psychosocial stress, the more we will be able to understand the extent to which psychosocial stress can contribute to disease, the more we can consider modifying the person's perceptions and reactions by using behavioral procedures to minimize the effects of psychosocial stress, and the more we can appreciate the need to take an integrated approach to stress management. Industry and labor can work together to both minimize sources of stress in the work environment (stage 1) as well as develop better means of coping with the work environment (stage 2) for the sake of the health of the worker and industry as a whole.

interns typically work more hours for less pay as part of the training experience. Nurses and physicians also can be trained to administer some types of stress management programs, and this option too should be pursued.

It is not possible to present in this paper detailed suggestions regarding specific directions for future research and applications, including possible alternative structures for incorporating stress management programs into occupational settings. However, I have provided a general introduction to the problems and promise of stress management as applied to occupational settings. The challenge is becoming clear. Whether the challenge will be met depends on the cooperation and collaboration of industry, labor, government, and the behavioral and biomedical sciences in the context of the emerging field of behavioral medicine (*7,8*).

References

1. Selye, H.: Stress in health and disease. Butterworths Publishers, Inc., Wolburn, Maine, 1976.
2. Weiner, H.: Psychobiology and human disease. American Elsevier Co., Inc., New York, 1977.
3. Williams, R. B., and Gentry, W. D., editors: Behavioral approaches to medical treatment. Ballinger Publishing Co., Cambridge, Mass., 1977.
4. McLean, A., editor: Occupational stress. Charles C Thomas, Publisher, Springfield, Ill., 1974
5. McLean, A., editor: Reducing occupational stress. Proceedings of a conference. DHEW Publication No. (NIOSH) 78–140. U.S. Government Printing Office, Washington, D.C., 1977.
6. McLean, A: How to reduce occupational stress. Addison-Wesley Publishing Co., Inc., Lexington, Mass., 1979.
7. Schwartz, G. E., and Weiss, S. M.: Proceedings of the Yale Conference on Behavioral Medicine. DHEW Publication No. (NIH) 78-1424. U.S. Government Printing Office, Washington, D.C., 1978.
8. Schwartz, G. E., and Weiss, S. M.: Behavioral medicine revisited: An amended definition. J Behav Med 1: 249–252; (*a*) 250 (1978).
9. Chesney, M. A., and Feuerstein, M.: Behavioral medicine in the occupational setting. *In* Behavioral medicine, edited by J. McNamara. Behaviordelia, Kalamazoo, Mich., 1979.
10. Weiman, C. G.: A study of occupational stressor and the incidence of disease/risk. J Occup Med 19: 119–122 (1977).
11. Selye, H.: The stress of life. McGraw-Hill, Inc., New York, 1956.
12. Zorn, E. W., Harrington, J. M., and Goethe, H.: Ischemic heart disease and work stress in West German sea pilots. J Occup Med 19: 762–765 (1977).
13. Dutton, L. M., et al.: Stress level of ambulance paramedics and fire fighters. J Occup Med 20: 111–115 (1978).
14. Holmes, T. H., and Rahe, R. H.: The social readjustment scale. J Psychosom Res 11: 213–218 (1967).
15. Chadwick, J. H., Chesney, M. A., and Feuerstein, M.: Psychological job stress and coronary heart disease. National Institute of Occupational Safety and Health, Cincinnati, Ohio. In press.
16. Moos, R. H., Insel, P. M., and Humphrey, B.: Work environment scale. Consulting Psychologists, Palo Alto, Calif., 1974.
17. Eysenck, H. J., and Eysenck, S. B. G.: Eysenck personality inventory. Education and Testing Service, San Diego, Calif., 1968.
18. Novaco, R.: Anger control: the development and evaluation of an experimental treatment. D.C. Heath and Co., Lexington, Mass., 1975.
19. Jacobson, E.: Progressive relaxation. University of Chicago Press, Chicago, 1938.
20. Schultz, J. H., and Luthe, W.: Autogenic training: a psychophysiological approach in psychotherapy. Grune and Stratton, New York, 1969.
21. Benson, H.: The relaxation response. William Morrow and Co., Inc., New York, 1975.
22. Goleman, D. J., and Schwartz, G. E.: Mediation as an intervention in stress reactivity. J Clin Consult Psychol 44: 45–466 (1976).
23. Carrington, P.: Freedom in meditation. Doubleday and Co., Inc., 1977.
24. Schwartz, G. E., and Beatty, J., editors: Biofeedback: theory and research. Academic Press, Inc., New York, 1977.
25. Silver, B. V., and Blanchard, E. B.: Biofeedback and relaxation training in the treatment of psychophysiological disorders: or are the machines really necessary? J Behav Med 1: 217–239 (1978).
26. Schwartz, G. E.: Research and feedback in clinical practice: a commentary on responsible biofeedback therapy. *In* Biofeedback: principles and practices for clinicians, edited by J. Basmajian. William and Wilkins Co., Baltimore, 1978.
27. Meichenbaum, D.: Cognitive-behavior modification. Plenum Publishing Corp., 1977.
28. Turk, D.: An expanded skills training approach for the treatment of experimentally induced pain. Doctoral dissertation, University of Waterloo, Ontario, 1976.
29. Peters, R. K., Benson, H., and Porter, D.: Daily relaxation response breaks in a working population. I. Effects on self-reported measures of health, performance and well-being. Am J Public Health 67: 946–953 (1977).
30. Peters, R. K., Benson, H., and Peters, J. M.: Daily relaxation response breaks in a working population. II. Effects on blood pressure. Am J Public Health 67: 954–959 (1977).
31. Kasl, S. V., and Cobbs, S.: Blood pressure changes in men undergoing job loss: A preliminary report. Psychosom Med 32: 19–39 (1970).
32. Mason, J.: A historical view of the stress field. J Human Stress 1: 6–12 (1975).
33. Schwartz, G. E.: Psychosomatic disorders and biofeedback: a psychobiological model of disregulation. *In* Psychopathology: experimental models, edited by J. D. Maser and M. E. P. Seligman. W. H. Freeman and Co., San Francisco, 1977.
34. Engel, G. L.: The need for a new medical model: a challenge for biomedicine. Science 196: 129–136 (1977).
35. Cannon, W. B.: The wisdom of the body. W. W. Norton & Co., Inc., New York, N.Y., 1932.