Chronic Pain*

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6

This chapter deals primarily with chronic pain observed in the clinical or medical setting. This type of pain and the experiences associated with it may relate to acute medical situations, psychiatric or emotional problems, and long-standing or chronic disabilities. Here chronic pain will be separated from both acute (recent onset) pain and experimental pain induced in laboratory settings.

The purpose of this chapter is to review behavioral methodology and strategies in the evaluation and treatment of chronic pain. No comprehensive overview of behavioral strategies is intended in this chapter and those interested in extensive descriptions of these classic techniques are referred to other sources (Bandura, 1969; Lazarus, 1972; Wolpe, 1969; Wolpe and Lazarus, 1966; Yates, 1970; Leitenberg, 1976.) Finally, while the focus will be on the learning aspects of an individual's experience of pain, it will not be limited to the individual alone. One must necessarily also be concerned with the impact of pain behavior on the immediate environment, and the extent to which antecedent and consequent events serve to effect each individual's perceptions and responses to pain.

The interest in behavioral management of chronic pain has increased steadily in the past decade. This is partially a result of the frequent ineffectiveness of traditional medical approaches where success rates for certain chronic pain problems (e.g., back pain) rarely exceed 60% and generally result in long-term success rates of less than 30% (Loeser, 1974). Similarily, discussions and descriptions of pain based solely on physiological or neurological factors fall short in their attempts to identify and account for all aspects of pain experienced in the clinical situation. This type of evidence, combined with the observation that placebo treatment alone can yield significant reduction in pain, has led investigators to adopt a more general and descriptive definition of pain which involves not only physiological sensations and mechanisms but behavioral and psychological components as well.

Pain has been referred to as complex and resisting definition. Weisenberg (1977) referred to pain as follows: "In some respects it is a sensation, in other respects it is an emotional-motivational phenomenon that

* Work for this chapter was supported in part by Rehabilitation Services Administration Grant 16-P-56818.

leads to escape and avoidance behavior" (p. 1009). This impression of pain as a primarily psychological experience is to some extent reiterated by Sternbach (1974) who reported that the word pain appears to be "an abstraction we use to refer to different feelings which have little in common except the quality of physical hurt, . . . a class of behaviors which operate to protect the organism from harm or to enlist aid in effecting relief" (p. 12). "Pain" then, appears to be generic in encompassing sensory, physiological, and behavioral components and is at once a sensation in response to a specific peripheral stimulation and the interaction of this response with a complex set of psychological and behavioral variables not easily described.

Further evidence suggesting the complexity of the concept of pain is provided in Beecher's reviews and articles where the psychological status of the patient appears to be the significant determinant of the efficacy of a pharmacological agent for reducing pain. For example, it was demonstrated that certain drugs, such as morphine, tend to work well for pain of a pathological origin (especially when this pain is associated with anxiety, not uncommon in a clinical situation), but these same drugs fail to work as well for experimentally produced pain (Beecher, 1972). Therefore, it has been suggested that one principle governing the action of medication and drugs is that certain pharmacological agents are effective only in the presence of a specific mental state (Beecher, 1972). A specific example of this hypothesis is presented by Sternbach (1968) who observed that pain tends to increase with anxiety. In addition, others have noticed that depression and anxiety are often significantly prevalent in patients reporting chronic pain (Merskey and Spear, 1967).

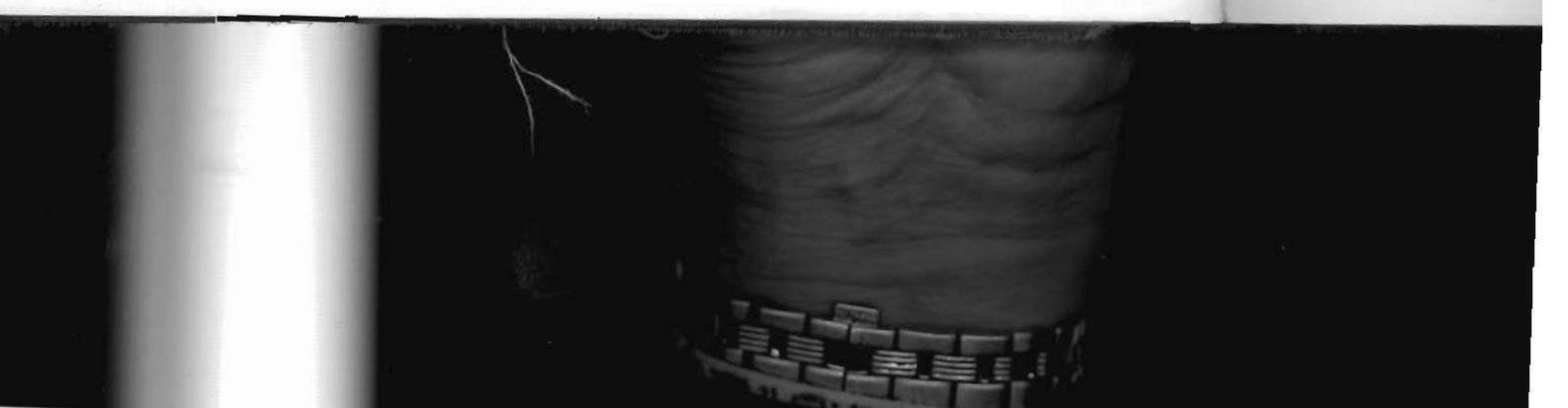
Further evidence of the significance of both emotional arousal and the secondary characteristics of the environment in which pain is imbedded is provided by Beecher's classic investigation. In this study, a comparison between the requests for narcotics for pain relief made by soldiers following wounds suffered in combat and those requested for narcotics made by hospitalized patients after comparable surgical wounds was made. It was discovered that only 25% of the wounded combat soldiers requested narcotics while greater than 80% of the hospital patients made similar requests for pain medication (Beecher, 1956). These studies indicate that cognitive set or expectancy, and individual's emotional state, and the negatively reinforcing or escape mechanisms (e.g., the secondary relief or gain provided a soldier allowed to leave the combat zone due to a wound) in the "pain environment" can all significantly effect the experience of pain.

Epidemiological factors may also interact with the physiology of the impingement of noxious stimulation upon an organism. For example, Tursky and Sternbach (1967) and Sternbach and Tursky (1965) demonstrated significant differences in reactions to electric shock in Yankees (Protestants of British descent with "phlegmetic, matter-of-fact orientation toward pain"), Irish subjects (described as inhibiting their pain expressions and sufferings), and Italians. A final anecdotal example of the cultural or learning history aspects of the experience of pain is provided by Christopherson (1966, p. 2) in describing a paragraph from a novel by Ruesch. In this description reference is made to the unexpected response of Eskimos in the face of anxiety and pain. Specifically, it has been reported that an Eskimo's response to pain is often to laugh, even when the stimulus involves a painful situation like having his arm ripped off by a polar bear. These studies and illustrations serve primarily to make the point that pain behavior or the response to pain can be influenced by a number of factors including mental set (cognitive expectancy) and the personality or anxiety state of the individual at a given time, and by such epidemiological variables as cultural upbringing (modeling).

Etiology of Pain

PHYSIOLOGY OF PAIN

To the neurophysiologist, pain is often conceptualized as some specific type of activity in the sensory system. Historically, the study of pain evolved from studies of the nature of pain in the human physiology. Von Frey initially proposed the specificity theory of pain in 1894 (Melzack and Wall, 1965). In this theory reference is made to specific receptors which result in the sen-



sation of pain when stimulated. These receptors were believed to be free nerve endings which, upon stimulation, would only result in the sensation of pain. Therefore, pain was believed to have its own central and peripheral mechanisms, similar to those of other specific bodily senses.

Half a century later, scientific evidence surfaced in support of specificity theory. Bonica (1953) observed that there is a specific and unique experience of pain originating in the skin when appropriate stimulation is applied. In addition, this same author identified two sets of fibers which had stimulus-specific, as well as differentiated, conducting properties that clearly are involved in the transmission of pain. This research and the parsimony of this theory led to its popularity for many years.

Despite the productive qualities of the specificity theory, it could not account for certain bits of scientific information which appeared and seemed to contradict its implications. Some of the earlier evidence testing the accuracy of this theory occurred in experiments involving experimentally induced anxiety. In these studies, subjects with induced anxiety reported significantly higher intensities of pain (Hill, Kornetsky, Flanary, et al., 1952). These same experimenters demonstrated that morphine decreased pain much more effectively when the patient's anxiety was high, yet had little or no effect if that person's anxiety level was low. Another break in the connection between a specific pain stimulus-response chain conceptualization occurred in Beecher's observations of combat wounds at Anzio. In this situation, specificity theory would predict that each type of severe wound would automatically generate severe pain response, while this author reported little or no pain experienced by the soldiers who were being removed from this life-threatening situation (Beecher, 1956). Furthermore, Christopherson (1966) demonstrated that there are significant and identifiable differences in the magnitude of pain responses to identical pain stimuli as a function of a person's cultural identity. This evidence in itself is sufficient to seriously question the omniscience of specificity theory in explaining pain. Additionally, further inadequacies in this theory surface, when it is realized that surgical intervention aimed at disengaging the specific connection between the peripheral body damage site and the supposed central pain mechanism (for example, nerve cuts, frontal lobotomies) have not met with widespread positive effects in alleviating chronic pain. Clearly, then, while specificity theory does account adequately for certain aspects of pain perception, it does not entirely describe the complex mechanism of pain perception.

In view of these inconsistent findings, it is not surprising that at approximately the same time as Von Frey was proposing his specificity theory, another author was hypothesizing about pain in a supposedly contrasting and mutually exclusive way. This alternative conceptualization of pain was labeled the pattern theory and was originally proposed in 1894 by Goldschneider (Melzack and Wall, 1965). This formulation contended that the sensations of pain experience by an individual are primarily related to the transmission of nerve impulse patterns originating from and coded at the peripheral stimulation site. Therefore, it was felt that the pattern of stimulation resulting from a noxious event needed to be coded by the central nervous system, and this resulted in the experience of pain rather than a specific connection between pain receptors and the pain sites.

While pattern theory does not account for the physiological evidence of nerve fiber specialization (Bonica, 1953; Melzack and Wall, 1965), there is evidence to support some of its major axioms. For example, Livingston (1943) suggested that peripheral stimulation from body damage may set up a type of reverberating circuit in the spinal internucial pools which summate in their effects and account for the fact that rapid, repeated peripheral stimulation (e.g., pinpricks) leads to intense pain. That is, the stimulus-response relationship is obviously not 1-to-1 (as would be predicted from specificity theory), but a type of overall intense pain is experienced. Further evidence of pattern theory for pain perception was provided by Noordenbos (1959) who suggested that central summation of impulses may be prevented by the action of rapidly conducting fibers inhibiting transmission by the slower conducting fibers. These findings are supported by the studies of Melzack and Wall (1962) where it was demonstrated that skin receptors have specialized physiological properties by which they may transmit

particular types and ranges of stimulation in the form of patterns of impulses. In this way, it can be seen that the pattern theory of pain allows for the existence of modulating or coding systems in the central nervous system (such as emotional state, prior experience, and alertness) which interact with the type of external stimulation to generate each person's pain experience.

The culmination of these theoretical trends and current state of the art appear to have occurred in the gate control theory (Melzack and Wall, 1965). This theory is summarized by Melzack (1968) as follows: "The theory proposes that (1) the substantia gelatinosa functions as a gate control system that modulates the amount of input transmitted from the peripheral fibers to the dorsal horn transmission (T) cells; (2) the dorsal column and dorsal lateral systems of the spinal cord act as a central control trigger, which activates selective brain processes that influence the modulating properties of the gate control system; and (3) the T cells activate neuromechanisms that constitute the action system responsible for both response and perception" (p. 362). This theory, then, proposes that pain phenomena are determined by the interaction between the above three systems, where effective closing of the gate results in pain *not* being experienced. In this system, the noxious stimulation of smaller A fibers results in rapidly transmitted and quickly experienced prickling pain where the gate could have little effect due to the short time delay. On the other hand, the slower C fiber impulses, which when stimulated can produce dull, diffuse, burning pain, can be affected by the closing of the gate, resulting in a decrease or elimination of the impact of such fibers on the pain perception. For this to happen, however, it has been hypothesized that activation of a system of nonpainful stimulation receptors (the large A fibers) is necessary. From this formulation it can be seen that both peripheral and central mediating factors can inhibit the transmission of slow pain impulses.

The gate control theory has been extremely useful in that it not only provided room for the evidence suggesting specific types of pain receptors (as well as allowing that pain stimulation and transmission may occur in patterns of sensations), but also allowed for the fact that central nervous system mediation is a significant factor in pain perception. Furthermore, this theory partially accounted for the types of fast-arising pain (e.g., cardiac pain, since the gate theoretically cannot close fast enough to inhibit all pain sensations) as well as the differential effects of time variables upon pain. That is, in addition to the stimulation of fast versus slow fibers, the gating effect is unstable, and the sequence of fiber stimulation can alter pain responses and perceptions. For example, movement can evoke renewed pain stimulation or rubbing adjacent skin areas (which activates large A fibers) can promote gate closure and thereby decrease pain. It is important to note that this last procedure, while consistent with the gate control theory of pain perception, is unlikely to yield a long-term benefit for chronic pain sufferers since continual stimulation of adjacent skin areas (despite its ability to provide competing stimulation for the central nervous system to process in lieu of pain) is unlikely to be maintained over a prolonged period of time.

This theory represented a major advance in the conceptualization of pain. Subsequent work on endorphins (endogenous morphine-like substances emanating from the brain) leads to alternative explanations for downward flowing pain inhibiting mechanisms and, therefore, calls into question some key details in gate control theory (Snyder, 1977). In addition, there are inherent limitations in the extent to which distraction, generation of competing stimuli and timing of sensations can be promoted as a way to decrease chronic pain problems. There are, however, strategies and tactics derived from the gate control theory which have an important role in pain management. These will be considered later. The major point is that this theory further supports the following formulations: (1) Pain is not a specific or discrete entity but rather a complex set of phenomena. (2) There is a loose link between specific noxious stimulation, peripheral to the central nervous system, and the sensation assumed to result from this stimulation, even when viewed physiologically. (3) Central nervous system and cerebral mediation are important ingredients in the perception of and responses to pain, opening the door for systematic

perusal of past experience, attentional set, and other cognitive-behavioral variables which might impinge upon the central nervous system and, thereby, interact with one's perceptions and sensations of pain.

It is important to remember that these theories relate primarily to the sensations of pain and how these occur in man. There is no inference about and little reference to what people do in response to their sensations of pain. How one responds to pain sensations is an issue as important as the specific mechanisms transmitting and generating pain experiences.

PAIN AS BEHAVIOR

Sternbach (1968) has observed: "In order to describe pain, it is necessary for the patient to do something . . . in order for us to determine that he is experiencing pain" (p. 13). That is, there must be some form of pain behavior by which diagnostic inferences and treatment judgments can be made. A patient will signal the type of pain he or she is experiencing by describing the intensity, frequency, location, and type of pain experienced. In addition to these verbal cues available to the patient's environment as an indication of his or her pain, there is a myriad of nonverbal signs used to communicate pain experiences. These include grimaces, sighs, moans, limps, awkward or strained body positions, the use of a cane or crutch, and many other symbols associated in our society with discomfort or physical problems.

The susceptibility of verbal report to the many types of response bias has long been accepted and documented (Orne, 1962; Rosenthal, 1966). These findings and the scientific dedication to identifying the specific underlying cause of any reported sensation or experience (e.g., pain) have generally led to a focus upon the physiological mechanism underlying a report of pain, rather than upon the verbalization itself. However, a recent study demonstrated that verbal report measures of pain tend to yield significantly finer stimulus discrimination measures and are more systematically correlated to stimulus variation than are specific physiological measures (Hilgard, 1969). Therefore, it appears that bypassing verbal report measures in favor of purely physiological ones does not necessarily yield a more precise indication or measure of the extent of a person's problems. We have thus come full circle and in a sense are left with the notion that pain as a concept is a complex set of things and not simply a sensory event. Moreover, the behavioral components clearly play a major role.

ACUTE AND CHRONIC PAIN

The previous discussion is not intended to deny the importance of physiological components in the pain experience. One may choose to think of "pain" as a sensory phenomenon, but a pain problem necessarily includes many behavioral components. The significant extent to which pain problems embody behavior (independent of physiological sensation) emphasizes the importance of learning and conditioning principles as they apply to understanding and treating those problems. This behavioral emphasis becomes particularly apparent in chronic pain.

The discrimination between acute and chronic pain is important, since the acute type (e.g., a sprained ankle, a broken leg, a laceration) is often the result of specific and readily identifiable tissue damage. In this situation, a professional is usually consulted about the acute problem and upon following specific advice, the pain is relieved and does not persist beyond the expected period of recuperation (usually a relatively short time). Conversely, while chronic pain typically begins with an acute episode as mentioned above, professional advice and prolonged evaluation and treatment strategies have not resulted in significant reduction of pain. In fact, the pain problem can be exacerbated by multiple surgeries or extended narcotic prescriptions, as in the case of low back pain. In these cases, treatment based on a biomedical model has failed to solve the patient's problem and chronicity has begun.

An additional variable which differentiates acute from chronic pain is related to the type of anxiety experienced by the patients. Acute pain experiences generally are associated with increasing amounts of anxiety as the pain intensity increases, followed

by a reduction in this anxiety once proper diagnosis and treatment begin. Reduction in anxiety, as previously discussed, generally results in a decrease in the pain sensation which is further alleviated by proper treatment. A similar cycle of anxiety (where anxiety decreases lead to perception of less pain) is seen in experimental pain situations where the subject knows that he or she need only endure the shock or discomfort for a finite and relatively short period of time, making toleration of this situation much easier.

The cycle is quite different for chronic pain patients in a clinical setting. In this situation, the initial anxiety associated with the pain experience persists and may eventually evolve into a feeling of helplessness and despair as the pain persists in spite of the health system's attempts to alleviate it. Without relief, the patient suffering from chronic pain begins to feel fatigued by constant pain and the relatively small amounts of sleep which result. In addition, he or she feels hopeless and frustrated, and cannot see an end to the suffering. With continuation of this scenario, the patient becomes increasingly frustrated and angry at the health care system or his or her immediate family, since no one has been able to provide a "cure" for the pain. Also by this time, typically it has been suggested that the pain may not be "real" and psychotherapy may be the only answer. To a person perceiving almost constant daily pain these suggestions are not anxiety-reducing.

The importance of the distinction between acute and chronic pain is further indicated by the work of Shealy and Maurer (1974). They analyzed the relative efficacy of transcutaneous nerve stimulation in treating chronic and acute pain. They found this particular treatment was 80% effective for the acute pain patients, but only 25% effective for the chronic pain patients. Given this type of result, it is not difficult to see how frustrated and helpless feelings can be readily generated in chronic pain patients.

Focusing upon tissue damage may be an effective and efficacious orientation in the treatment of acute pain, but this unidimensional approach appears to be much more problematic in dealing with chronic pain and may lead to fallacious conclusions. To further illustrate, causalgia (a burning pain associated with deformation of nerves by bullets or other high-velocity missiles) typically persists for months after the tissue damage has healed. This example may provide a useful model for chronic pain, since it implies that the pain sensations or experiences associated with the initial tissue damage are similar to those which persist and are like the sensations described by the patient in the absence of any prolonged or renewed tissue damage. This is likely a part of the cause behind many chronic pain patients' pleadings that "it really is hurting me, the pain is very real and I'm not making it up."

PSYCHOGENIC PAIN

After repeated treatment failures based solely on a biomedical model, the patient's medical history will have begun to grow. Often he or she will come to be labeled as a "crock," or otherwise rejected by the health care system with the implication that the failure of treatment is somehow the patient's fault. However, it is the system that has failed to provide adequate treatment and simultaneously failed to identify a specific "cause" for the origin of the persisting pain sensations. This generally leads to the patient's experiences of pain being labeled as psychogenic in nature.

The phrase "psychogenic pain" is used in a variety of ways with little concurrence among professionals about the specific intent of this label. In a broad sense, this labeling is an attempt to identify patients whose complaints of pain or whose "pain behavior" (Fordyce, Fowler, Lehmann, et al., 1968; Sternbach and Fordyce, 1975; Fordyce, 1976) are discrepant from the measurements taken concerning the physiological sensations and probable peripheral nociceptive stimuli existent in this patient. For example, if the patient presents him/herself to a physician complaining of severe neck pain and (following a comprehensive series of X-rays and medical procedures) no physiological evidence consistent with this report is found, it is assumed that the patient is "making up" or exaggerating the extent of the neck pain. Hence, the label "psychogenic pain" is applied. In this instance, therefore, strong reliance is placed upon the low stimulus-response correlation

and the psychogenic label refers primarily to the large discrepancy between reported pain and the measured physiological causes for such pain (Fordyce, 1976). In this sense, it is a label and not an explanation.

Another use of the term psychogenic is more specific and perhaps more useful. In this formulation, emotional and psychological factors are assumed to be the primary cause of a patient's pain. Merskey (1968) hypothesized that this type of psychogenic pain occurs under three conditions: (1) during hallucinating experiences in schizophrenics; (2) due to muscle tension caused by psychological factors like obsessive fear or worry; and (3) in conversion hysteria. This conceptualization stems primarily from the observations that certain types of psychiatric illness are often associated with complaints of pain (Spear, 1967; Sternbach, 1974). While this useage of the phrase psychogenic pain attempts to explain the discrepancy between observed and measured stimuli for pain and the reported pain experience in some quantifiable terms (for example, levels of depression or certain personality variables), the experience of the patient is unknown. In fact, adding "psychogenic" to a pain diagnosis serves primarily to raise issues of philosophical cause and effect, or mind-body concepts, and does little to establish whether there is a cause-effect relationship between cortical or centrally mediated functions and the sensation of pain. This tautology regarding pain has been analyzed as follows: "the essence of the problem lies in assuming that there are real mental and physical events which can and do interact. In fact, there are simply phenomena which we describe in physical language or mental language; we delude ourselves to believe that because we can impose both mental and physical concepts on such an abstraction as 'pain,' that in fact, such a causative sequence exists" (Sternbach and Fordyce, 1975, p. 122). What does remain, in spite of any arbitrary labeling or complicated diagnostic workup, is the behavior of a patient reporting pain.

THE "DISEASE" MODEL OF PAIN

From the above discussion, it should be evident that a simplistic stimulus-response notion of clinical pain is inadequate. Such a view suggests that pain behavior is highly correlated with the evidence of tissue damage or physiological pain sensation transmission. Furthermore, either elimination of the stimulus or the interruption of the pain pathway should suffice to decrease pain experiences significantly. However, as previously noted, surgical results attempting to effect such a change have been generally disappointing in terms of their efficacy with chronic pain (Weisenberg, 1975, Section 7). Further evidence contraindicating the stimulus-response notion of pain is provided by Loeser (1977), who clinically identified examples of pain for which there was no apparent stimulus (e.g., central pain). Despite such evidence, the predominant treatment for chronic pain has continued to be based upon a pain stimulus-pain response formulation, which can be characterized as a biomedical or disease model approach to clinical pain treatment, as described by Fordyce and his colleagues (Fordyce et al., 1968; Fordyce, Fowler, Lehmann, et al., 1973).

A disease model of pain leads to treatment regimens focusing upon removing the inferred or observed underlying body damage factor with the expectation that the symptoms will then disappear. There is little emphasis placed upon treating symptoms per se, since it is assumed that the underlying pathological condition is the primary, if not sole, source of the symptom pattern. As noted, in the case of acute pain, this approach is relatively effective. Treating the underlying cause usually leads to an efficient and effective amelioration of the patient's pain (e.g., setting a leg in a cast and immobilizing it until the tissue damage is healed). The complications begin when either the diagnostic procedure fails to identify the correct body damage etiologic factors contributing to the symptoms of pain, or when the series of treatments actually decrease the "underlying pathology" but fail to relieve the patient of pain. This is most often the case with chronic pain patients. It implies the pain behaviors were only partially or not at all related to the identified tissue damage.

After several equally ineffective diagnostic and treatment procedures aimed at treating underlying pathological causes for his or her particular pain, the patient is often referred for psychiatric evaluation

and perhaps for psychotherapy. A call for psychological intervention is generally based on the same disease model perspective; that there must be some underlying pathology (now assumed to be of a psychological nature) which needs to be treated in order for the pain symptoms to cease. While it is certainly true that some psychiatric and psychological strategies do focus upon emotional "causes" of pain (which can alleviate pain symptoms, especially muscle tension-related pain), there is a growing body of literature suggesting that patients with pain (whether labeled as "organic" or "psychogenic") are more similar in their psychological makeup than different (Woodforde and Merskey, 1972; Fordyce, Brena, DeLateur, et al., 1978; Sternbach, Wolf, Murphy, et al., 1973). These studies suggest that while people with chronic pain do tend to be more depressed and concerned about physiological symptoms than other pain patients; there are few differences between them in psychological measures, regardless of the evidence for underlying organic cause for their pain. It follows that reliance solely upon disease model concepts and attributing the pain behaviors to underlying pathological factors cannot suffice. Nor does it suffice to postulate as the only alternative explanation for the pain the effect of some psychic or emotional problem somehow manifested as "pain."

OPERANT VERSUS RESPONDENT PAIN

A more useful conceptualization of pain can be drawn from the differentiation between operant and respondent types of behavior. In chronic clinical pain, the "pain" must be understood in terms of behavior by which it is manifested. That behavior is subject to all of the laws of learning and conditioning. Respondent behavior occurs in response to a specific stimulus. Respondent behavior fits a stimulus response model because it occurs automatically when an adequate stimulus is presented; i.e., the behavior responds to the stimulus. Examples of respondent behavior include the knee jerk reflex, the eye blink in response to a puff of air, etc. Respondent pain behavior refers to pain behavior controlled by antecedent and specific nociceptive stimuli.

Operant behaviors, like respondent, can be produced by specific stimuli, but are also sensitive to the influence of factors occurring during and after the presentation of the stimulus. When an operant is followed systematically by either a reward or a punishment, the result is an increase or decrease, respectively, in the likelihood the behavior will occur in the future. One distinction, then, between operant and respondent behavior, is that while a respondent behavior's magnitude is dependent primarily upon the specific type and duration of the antecedent stimulus, an operant behavior can be increased in magnitude and frequency by systematic positive consequences following its occurrence. Similarly and in contrast to respondent behaviors, operants which are systematically followed by neutral or negative consequences (i.e., extinguished or punished) occur less frequently or with decreased magnitude of response. A problem of operant pain is one in which the pain behaviors can be said to have come under control of contingent environmental reinforcement. A problem of operant pain may evolve when the original respondent pain situation persists long enough under circumstances favorable to conditioning. The ever-changing scientific knowledge surrounding physiological functions and self-control (especially related to biofeedback procedures demonstrating self-control of previously assumed automatic physiological functions) are continually demanding re-clarification of the distinction between operant and respondent types of behavior. More and more, behaviors originally thought to be insensitive to contingent reinforcement and therefore exclusively respondent, now are recognized as potentially operant because they can be conditioned.

Acquisition of Operant Pain

The following illustrations may help to clarify the respondent-operant distinction. A careless person backs suddenly into an open cupboard door and sharply strikes the occipital area. This may be followed immediately by a sharp pain, and gasping, grimacing, or moaning, as well as dizziness or visual blurring. These sensations slowly fade as the time passes. In this case, the pain is respondent; the pain behaviors occur automatically in response to a specific stimulus.

In a similar situation, another person, hurrying around as part of the morning ritual of preparing for work, inadvertently has a similar accident. But suppose this person's spouse has observed the incident and quickly expresses much attention and concern. A series of questions concerning the physiological status and well being follows and the victim receives the luxury of being driven to and from work on this particular day.

In both examples, there presumably will have been some amount of subjective distress or "pain." In both cases there also occurred some visible/audible pain behavior in response to the noxious stimulus of the bump on the head; i.e., there was some respondent pain behavior. In the first illustration, those respondent pain behaviors were not followed by systematic and pain contingent environmental reinforcement. The problem of respondent pain fades. In the second illustration, there were immediate and perhaps intense environmental reaction or consequences to the respondent pain behaviors. Those consequences were pain contingent; i.e., had the pain behaviors not occurred, the particular environmental consequences would not have occurred. The second example illustrates a situation having potential for conditioning a respondent pain problem to become an operant one. The likelihood that such would occur would be some complex function of the extent of the injury and therefore of the initial persistence of the respondent pain behaviors, of the potency or meaningfulness to the victim of the ministrations of the spouse, and of the persistence and militancy with which those spouse-arising consequences continue to occur as pain behaviors occur. Note also in the second illustration that the spouse made two kinds of intervention. One was to attend closely to pain behaviors. The second was to discourage the victim from full continuation of well behavior by insisting on driving the person to and from the job.

Pain behaviors can occur as direct and automatic responses to specific antecedent stimuli, thereby functioning as respondents. They may also occur independently of such antecedent stimuli, their persistence maintained by the positive or negative consequences to which they lead. It is of utmost importance to recognize, when confronted with chronic pain, that the pain behaviors observed can occur independent of physiological stimuli. They may be primarily under the control of a set of environmental contingencies outside the patient experiencing the pain. The implications of this possibility are pervasive. Adequate treatment of chronic pain often necessarily involves evaluation and eventually modification of the relevant environmental contingencies if lasting change is to be achieved.

"WELL" BEHAVIOR

An additional component of operant pain consists of the behaviors related to "well" role activities. Not only are the pain behaviors (e.g., moans, grimaces, limps) subject to operant learning principles, but the complement behaviors (i.e., "healthy" or nonpain behaviors) are equally prone to the effects of learning and conditioning principles. A chronic pain situation may involve not only the reinforcement of pain behaviors, but also nonreinforcement or punishment of well behavior.

The concept of development of alternative responses incompatible with sick behavior (e.g., activity, "well behavior," relaxation) have been demonstrated to be an effective way to combat depression (Lewinsohn, 1974), and anxiety (Wolpe, 1958), as well as pain (Fordyce et al., 1973). In any problem of chronic pain there may be, in addition to or instead of, respondent pain behaviors, either or both of two conditioning effects; (1) reinforced pain behavior; and (2) punished or nonreinforced well behavior.

TIME LIMITATIONS

A basic principle of conditioning is that learning and conditioning effects are time-limited. An operant behavior established or conditioned will be maintained only as long as reinforcing contingencies are applied. The rate and magnitude of reinforcement may diminish, but if the positive consequence is completely halted, the operant behavior will eventually extinguish. In the situation of chronic pain, this is both a blessing and a curse. Specifically, it is reassuring to know that one needs only to remove positively reinforcing consequences

for pain behaviors to have them decrease in frequency and possibly disappear altogether. Conversely, this same principle applies for healthy behaviors. The cessation of effective positive consequences leads to a decrease in well behaviors.

This presents a particular dilemma if an individual patient's behavioral repertoire includes few socially reinforceable, health-oriented behaviors. Furthermore, this principle points up the necessity for in-depth analysis of the consequences built into the pain patient's environment. Those which reinforce pain behaviors or punish well behaviors will need to be altered if there is to be any chance for long-term decrease in pain behaviors.

DIRECT REINFORCEMENT

Direct positive reinforcement is one of the ways in which pain behaviors are often encouraged by the environment. Most people have suffered acute pain and noted that positive attention from some aspect of the environment is associated with their pain behavior. Sometimes such special attention occurs virtually only when there is pain or illness; i.e., it is pain-contingent, thereby increasing its reinforcing properties. As the duration of pain increases, there is more opportunity for pain behavior to be systematically followed by reinforcement. That is, the connection between complaints about pain and attentiveness (whether nagging or positive affection) occurs more often and the probability of conditioning pain behavior to produce an operant pain problem increases. For example, a husband may rarely comment about his wife's adequate housekeeping or excellent meal preparation, but display overt positive affection in the form of solicitude, rubbing her neck, or taking over arduous chores whenever she comments about discomfort. In this example, the woman's pain behaviors are receiving reinforcement and her well behaviors discouragement, within the same situation.

An additional source of direct reinforcement for operant pain behavior is the health care system. Genuine professional concern and attention can inadvertently encourage the continuance of pain complaints. This is particularly true when the patient does not have adequate social outlets and may be gaining much of his or her social contact through association with a health care facility. The attention or concern of a doctor, a consequence viewed by some as negative and indicative of ill health, may be positive and encouraging for other people. Contingent consequences may, in fact, be reinforcing for a given individual, even if they may seem onerous or aversive to others.

An even more potent pain contingent direct reinforcement of pain behaviors by physicians occurs when narcotics or potent analgesics are prescribed for long intervals on a *prn* or take-only-as-needed basis. That arrangement makes the consequences of medications, with whatever chemotherapeutic effects they have, pain contingent. The person must engage in some form of pain behavior in order to receive the medications. Clinical experience indicates a startling number of chronic pain patients who virtually cease to give evidence of any pain problems when they are helped to detoxify and to get rid of their medication habits.

Monetary compensation is another example of how pain behavior can be positively and directly reinforced. The patient on disability compensation is required to demonstrate disability to continue receiving monthly checks. Regardless of the initial cause for pain or disability, this situation has considerable potential for increasing the frequency and intensity with which a person expresses pain behaviors. It both directly reinforces pain behavior and diminishes the monetary aversiveness of being unable to work.

Another consequence for pain behavior which proves often to be an effective reinforcer is rest. A person experiencing pain in its respondent or acute stage, may find that increases in physical activity generate discomfort, while decreases in activity lead to lower pain levels. Lying down or resting is then a positively reinforcing event. The increased comfort positively reinforces the resting behavior, increasing the chances that it will occur in the future. This method of conditioning of pain behaviors seems particularly important and prevalent. In the initial stages of acute pain, rest is often an effective and appropriate treatment strategy because it reduces discomfort and minimizes movement and getting into exacerbating situations likely to increase the tis-

sue damage. However, when pain persists and becomes chronic in nature, the therapeutic properties of rest, in terms of minimizing body damage, almost always diminish. Concomitantly, reduced physiological tonus and diminished effectiveness of well behavior are increased.

INDIRECT REINFORCEMENT (TIME-OUT)

Rest from noxious physical activity is related also to indirect reinforcement of pain behavior. In indirect reinforcement, pain behavior is frequently reinforced by allowing the patient to remove him/herself from a difficult or stressful situation. The situation may be physically tiring, for example, or it may consist of stressful interpersonal conditions such as a bad work situation which the patient finds aversive and would rather avoid. A complaint about pain may lead to staying home from a difficult job, time-out from engaging in sexual intercourse (which to some is aversive), avoiding arguments with a supervisor, or avoiding burdensome chores by remaining in bed.

Learning by indirect reinforcement is *avoidance conditioning*. This type of learning can be very resistant to change. For example, consider a male patient who has had a serious back injury for several years but who has adjusted to the discomfort and mild physical limitations imposed by this condition. Suppose he now changes jobs and encounters a new stressful job situation. Subsequently, a back strain may occur as happens to most of us in the course of normal living. The relief of prescribed rest experienced following a stay at home for the first day or two may have far reaching effects. That is, the following morning, independent of the actual discomfort experienced from the back strain, anticipating the work stress, this person may readily accept suggestions from his environment (e.g., a spouse) to take an extra day to recuperate and then another, and so on. The successful avoidance of an anxiety-producing or stressful situation at work will reinforce *any* behavior which facilitated the avoidance, in this case: the pain behavior.

Another common avoidance behavior relates to compensatory body positions adopted by people initially suffering from acute pain. For example, the person with a broken leg and resultant long casting interval, may initially have tenderness in the leg during ambulation. The pain encourages the patient to favor the leg during the healing process by generating a slight limp to avoid or minimize pain. In some individuals, the immediate reduction or avoidance of sharp pain from this new behavior is reinforcing enough that the limp becomes a habit not easily discarded. In addition, the patient's anticipation of pain discourages trying to walk without the limp. Finally, display of the limp may continue to elicit special attention and support from others. This example illustrates how pain behaviors serving as avoidance or escape mechanisms can generate longstanding habits which are highly perseverative.

MODELING

In addition to direct and indirect reinforcement, imitation or modeling effects can have a significant impact on chronic pain behavior. It has been shown that humans see or hear another's behavior and often will imitate some or all of that particular behavior (Bandura, 1965; Bandura and Walters, 1963).

Imitative behavior may occur with or without our awareness, as evidenced by language acquisition in infants. The importance of modeling effects in the acquisition of chronic pain is suggested by research demonstrating a tendency for individuals to imitate behavior which is reinforced and avoid behavior which is punished. Craig (1975), for example, has shown that modeling can influence "pain tolerance"; i.e., readiness to express distress. Parental or sibling responses to pain are potential learning situations for any child. Parents who readily and dramatically express pain behaviors in response to noxious stimuli and who respond to such behavior in others are likely to find that the child will imitate or model this response to noxious stimuli. The evidence suggesting significant cultural differences in the responses to pain almost certainly illustrates the effects of modeling.

OTHER FACTORS

It should be apparent from the preceding formulation of the acquisition and etiology of operant chronic pain, that the conse-

quences of a long-standing and difficult pain problem are likely to be decreased activity, decreased social effectiveness, and decreased vocational effectiveness. The existence of clinical levels of depression is also observed in many chronic pain patients (Merskey and Spear, 1967; Sternbach, 1974). Behavioral conceptualizations of the etiology and treatment for depression have particular relevance to chronic pain, since they share the learning and conditioning framework as a basis for their treatment (Ferster, 1966; Lewinsohn and Atwood, 1968). These issues and others as they relate specifically to the treatment for chronic pain will be reviewed in the treatment section.

Review of Treatment Strategies for Chronic Pain

METHODOLOGICAL ISSUES

One of the most difficult issues in evaluating the effectiveness of any treatment strategy for chronic pain is selection of outcome criteria. The problem is essentially definitional. Among various approaches in the treatment of chronic pain, there appears still to be considerable confusion as to the nature of the problem being treated. The confusion seems to arise primarily through a blurring of the distinction between "pain" as a form of sensation, "suffering" as a negatively toned affective or feeling state, and "pain behavior"—the visible or audible manifestations of the patient's problem.† Clinicians typically use the term "pain" when in fact the phenomena they are observing and are using to arrive at judgements is mainly pain behavior. They are also making a three-stage inference when they do this, often without being aware of it. They are assuming first that the pain behaviors are direct reflections of underlying suffering which, in turn, is elicited by the sensation of "pain," which, finally, is elicited by nociception. Without doubt, there is a sensory system which, when stimulated, is capable of leading to the sensation of pain. But that sensation is not the clinical problem. "Pain," as a sensation, activates higher nervous centers which generate "suffering." But that, like "pain," remains a private experience not yet in the observable, confirmable, treatable domain of the clinician. "Suffering" leads to pain behaviors, previously defined.

The complicating element to the matter is that both "suffering" and "pain behavior," mediated by higher nervous centers, are subject to influence by a variety of factors, some quite foreign and unrelated to nociception and "pain." Prior experience, current affective states, and prevailing environmental contingencies all can and do influence both suffering and pain behavior. Moreover, pain behavior is quite capable of occurring in the absence of suffering.

As clinicians in the context of treating chronic pain, we deal with two sets of information. Foremost, we are confronted with and may observe and measure pain behavior. We may, as circumstances dictate, *infer* that those pain behaviors are an extension or reflection of underlying suffering, although there are alternative possibilities of which we must be mindful. We may also infer that the suffering has been elicited by the sensation of pain which, in turn, occurs because of nociception. Again, however, there are alternative possibilities. Aside from the direct observations of pain behavior, these conclusions are all inferential. The second set of information at hand for the clinician to consider is the medical history. The residual effects of previous trauma, effectiveness of prior treatment interventions for the reported pain problem, and "physical findings" derived from the current medical workup may be considered. That second set of information bears directly on the question of nociception. The information does not describe current nociception. The information may, with varying degrees of precision and reliability, provide a basis for *inferring* that there is currently nociceptive input. In essence, those kinds of data provide a basis for speculation as to the presence of nociception. They do not demonstrate or confirm either the presence of nociception or, if present, that no-

† This conceptualization is the work of John D. Loeser, M.D., Department of Neurological Surgery, University of Washington, Seattle, to whom a special note of gratitude is expressed. It represents, in the view of the authors, the clearest organization and conceptualization of the major dimensions of chronic pain yet formulated.

ciception accounts for the observed pain behaviors. This is not to suggest that this speculation or inference is always highly questionable. Indeed, the evidence may be most compelling. However, it is still an inference or a speculation.

In problems of acute or recent pain onset, the linkage between the "physical findings" data and the pain behaviors is generally rather direct. The major exceptions are likely to relate to people with an extensive prior history of extended bouts of pain behavior.

In problems of chronic pain, the opportunity for other factors (e.g., prior experience, emotional or affective problems, and contingent environmental reinforcement) to have begun to exert influence on the pain behaviors is assured. How much that influence has distorted the linkage between speculated nociception and observed pain behavior remains to be clarified, principally by the kinds of behavioral analysis described in this chapter.

In acute pain, treatment aimed at removing or reducing nociception is often the desired point of attack. However, even then, the criterion of success ought to be pain behavior, or lack of it. Patient reports of alterations in amount of suffering are subject to many distortions and should be given limited credibility. In evaluating treatment of chronic pain, clearly the criterion should be changes in pain behavior.

The question often arises as to whether changes in pain behavior correlate with changes in nociception and (presumably) associated "pain" as a sensation. That is, if a treatment program has focused on changing pain behavior, will the "pain" remain, although now unexpressed behaviorally? The answer to the question can be neither confirmed nor disconfirmed, so this is a specious consideration. One can only describe and measure what patients do, while recognizing that what they say about suffering is a complex social communication linked to many parameters both within and without the organism.

It has been argued that ignoring the pain patient's feelings is an arbitrary approach derived from social learning theory but not necessarily essential to treatment. However, Hilgard and Hilgard (1975) found that immediately following the successful treatment of chronic pain, many patients reported hurting as much as they had before treatment started, yet these same patients were reportedly pain free 6 to 12 months later. Similarly, Fordyce et al. (1973) have shown that reports of hourly discomfort and ratings of interference with daily activities due to pain tend to remain the same or increase slightly over the course of treatment for many chronic pain patients. However, the outcome of treatment for this group of patients was positive for all other criteria (e.g., activity tolerance, uptime, medication use). It is difficult to assess whether these findings suggest that chronic pain patients' reports about continuing pain during successful treatment are simply an attempt to validate a continuing claim to pain, or whether this is one more example of attitude change occurring after behavior change. In either case, it appears that subjective reports of pain in chronic pain patients are not consistent with other measures of treatment outcome and progress.

If not verbal reports of pain, then what criteria can be used to evaluate the outcome in chronic pain treatment? As might be expected, criteria vary from treatment center to treatment center and from researcher to researcher. Nevertheless, there appear to be some generally accepted and useful guidelines. Observable and measurable criteria appear to have the most utility both in terms of evaluating the treatment's efficacy and in terms of providing the patient evidence of his or her improvement (despite "feeling" just as much pain). Such variables as uptime, number of miles walked in an hour, pounds lifted in a given body position, levels of muscle tension (measured by surface electromyography), amount of analgesic medication used per day, or hours of sitting tolerance can provide objective measures upon which to base outcome assessment decisions. Such measures avoid the complications of variable memory, response bias, positive and negative social desirability effects, and attempts to manipulate pain medication levels and provide the patient and therapist with a reliable determination of treatment progress. Perhaps, more importantly, these types of outcome criteria are more likely to generalize to actual life situations outside the treatment setting (e.g., work and avocational pursuits).

Most of the studies for the treatment of chronic pain have employed clinical case study designs, with no control groups and no placebo-control methodology. In addition, these studies have rarely separated different treatment elements, often combining several techniques in one package (e.g., physical therapy, occupational therapy, chemical management, psychotherapy, and physician reassurance and workup). Because of this, it is impossible to separate the essential ingredients or tease out the more important aspects of a given treatment program. To overcome these limitations, many of the clinical or research-oriented programs (e.g., at Minnesota and Washington) implement extended baseline periods in which patients keep records at home about their daily activities. In this way, an attempt is made to assess the effects of positive anticipation resulting from having been accepted into a reputedly effective program. In addition, long follow-up periods (2–5 years) are employed to minimize reporting bias and to measure the long-term effects of treatment more effectively. Since most chronic pain patients have had their problems for years, and since most placebo effects are short-lived, incorrect evaluation of outcome under these conditions becomes less likely. *Nevertheless, it is important to note that a systematic, controlled study of alternative approaches to similar pain problems has yet to be attempted.*

INPATIENT STRATEGIES

There are over 100 pain clinics in the United States, yet only a handful have published results concerning their efficacy. The inpatient strategies can be divided into two types: (1) "pure" behavioral or operant and (2) "mixed" behavioral and other. All of the inpatient treatment programs involve several aspects, including medication management, physical and occupational therapy, and supportive therapy. The difference between behavioral and mixed approaches is the extent to which the treatment involves strategies other than reinforcement for "well behavior" (e.g., group discussion with other patients, biofeedback for relaxation and placebo, family therapy not related to pain behavior management).

The prototype "pure" operant pain treatment program originated at the University of Washington Department of Rehabilitation Medicine. The program involves a 4- to 8-week inpatient period designed to increase gradually general activity level and socialization and to decrease medication usage and, ultimately, pain-related utilization of health services. This is accomplished through the use of quota systems of physical, occupational, and vocational activities which are part of a contingency plan. (A more detailed description of this treatment will be presented later in this chapter.) Using the approach, Fordyce et al. (1973) were able to obtain significant increases in uptime and activity level (exercises, walking, non-reclining time), and significant decreases in medication (narcotic and nonnarcotic analgesics) usage. On the average, the changes were maintained at follow-up 22 months later.

In a similar treatment program in the Pain Clinic at the University of Minnesota Department of Rehabilitation Medicine, significant treatment gains were also observed following treatment in 75 to 80% of the patients (Roberts, in press). These gains were reported to have maintained in "most" of the patients for from 1 to 8 years (Anderson, Cole, Gullickson, et al., in press). One problem with the latter study, however, is the use of subjective outcome criteria (e.g., significant gains were viewed in terms of the patient leading a "normal life without pain medication"). Another inpatient operant-pain treatment center, Rancho Los Amigos Hospital in Downey, California, noted in a report on their program for treating chronic low back pain, that 70% of the patients indicated either some reduction in pain *or* an increase in activity level, with analgesic medication reduced to zero by the end of treatment for all patients. The decrease in medication was maintained in 58% of the patients at follow-up (10 months), with 74% not seeking further health care and 75% working or in a vocational training program (Cairns, Thomas, Mooney, et al., 1976). Although in most cases the post-treatment levels of functioning were significantly improved over the pretreatment levels, the above studies are limited by reliance upon subjective questionnaire data as the basis for follow-up evaluation.

An extension of these programs and a good example of the "mixed" approach exists at the Mayo Clinic. In this system, the average length of inpatient stay is about 3 weeks and treatment involves those aspects described in the "pure" programs as well as group exercises, organized group discussion among patients, and biofeedback and relaxation techniques to augment physical and occupational therapy. The results of this treatment approach were that 27 out of the 50 (54%) patients accepted into the program showed a moderate to marked improvement at post-treatment. These results may be a spuriously low estimate of the program's potential effectiveness, since 16 of the original patients dropped out of the program and of the 34 who completed treatment, 79% (27) showed improvement. Unfortunately, at 6 months follow-up only 50% of those who completed treatment had maintained their gains (Swanson, Floreen, and Swenson, 1976). Again, the criteria for outcome assessment are vague and are related to such subjective variables as attitude modification (remaining in the program and "generally accepting" the need to live with pain), changes in physical function (performing work-equivalent activities), and medication reduction; points were assigned to yield outcome "scores." While these measures are, at least, an attempt to specify outcome criteria, they leave far too much discretion to the raters.

A similar multidisciplinary approach lasting about 3 weeks has been evaluated by Newman, Seres, Yospe, et al. (1978). In this report, it was demonstrated that significant gains were maintained for chronic low-back patients in the reduction of analgesics and on four measures of physical functioning. An important aspect of the study is that follow-up occurred at 80 weeks and was done in the hospital by direct evaluation, thus minimizing the effects of biased verbal reports. As has been reported previously, these researchers also found that patients' verbalizations of pain did not change over the course of treatment, despite alterations in other behaviors.

Another mixed inpatient approach to the treatment of chronic pain, lasting 4 weeks, is situated on a neurological service and employs operant approaches, physical rehabilitation, and work-related procedures as well as group transactional and gestalt techniques (Greenhoot and Sternbach, 1974). Evaluation of treatment outcome for the 62 chronic-pain patients indicated that significant improvements in pain reports, medication use, and activity levels resulted. As has often been the case, however, at the 6-month follow-up, only medication use remained at the post-treatment level, with subjective pain reports and activity levels regressing toward pretreatment levels, although still significantly improved (Sternbach, 1974). Again, questionnaire data provided the data base for this analysis and no account was given for the one-third of follow-up patients who did not respond to the questionnaire.

A final example of the "mixed" inpatient approach to chronic pain treatment is evidenced by the Chronic Back Pain Management Program, Casa Colina Hospital for Rehabilitation in Pomona, California. In this setting, low-back pain patients are treated for an average of 6½ weeks with a variety of treatment modalities, designed around the theme of self-regulation. The treatment approach is similar to the one used at the Mayo Clinic in that it uses biofeedback for muscle tension reduction, group discussion among patients, and occupational and physical therapy. In addition, self-regulation techniques are taught using psychological counseling for stress management and assertion training, patient-regulated medication programs, and didactic presentations. A vocational planning service as well as individual and marital counseling are also provided. At the end of treatment, 57 of the initial 72 low-back pain patients demonstrated unimpaired physical movement and 59 of 72 were functioning successfully in vocational activities (Gottlieb, Strite, Koller, et al., 1977). Furthermore, using a clinical rating system based on physical functioning, clinical judgment, and vocational restoration, about 66% of the patients showed significant improvement, maintained at a 1-month follow-up. Given that 33% of the initially referred patients either dropped out of the program or were rejected by the staff on the basis of low level of involvement and that treatment involved many modalities in addition to self-control, it is difficult to evaluate the authors' claims that self-

regulation plays a critical role in the treatment of chronic low-back pain. However, the use of operationalized outcome criteria (e.g., 1 point for walking less than 400 m, 4 points for walking over 1600 m, 3 points for 45 minutes sitting tolerance, 4 points for no pain-related medication intake other than aspirin) is a significant step in the direction of clarity and allows comparison with other programs with respect to the same variables. It is unfortunate that this approach was not uniformly applied across all outcome variables. Further operationalization of different outcome variables will be necessary if important psychological indicators are to be compared across treatment modalities and settings.

OUTPATIENT STRATEGIES

There are few critically evaluated studies on the effectiveness of outpatient treatment of chronic pain. Generally, the outpatient approaches consist of the same procedures as the inpatient, but implementation is in vivo using an intermediate such as the spouse. The difficulty of obtaining accurate and incorruptible observations of activity and medication on an outpatient basis puts this strategy at a greater risk of failure and may account for the paucity of studies in the area.

A recent and promising outpatient treatment strategy for chronic pain is labeled "cognitive-behavioral" (Turk, 1978). Typically, this approach is designed to reduce anxiety and covert self-statements concerning pain. In this way, it is hoped that indirect modification of pain perception and tolerance will occur and allow the patient to increase his or her activity levels and decrease medication use. Some outpatient treatment approaches for chronic pain have not been employed extensively enough to warrant discussion of efficacy. As can be gleaned from other chapters in this volume, however, chronic muscle tension pain (e.g., tension headaches, spasms) and vascular pain (e.g., migraine headaches) seem to respond well to outpatient biofeedback treatment and may not require the more intensive inpatient programs.

One of the most recent cognitive-behavioral techniques is "stress inoculation" (Meichenbaum and Turk, 1976). This outpatient technique combines didactic discussion about stress reactions, generation of alternative self-statements about one's ability to cope with stress, specific relaxation training, and in vivo application of newly learned stress coping mechanisms. While this approach has not been used with chronic pain patients to a large extent, stress inoculation incorporates many of the essential aspects of the effective inpatient chronic pain treatments (e.g., identifying antecedents of stress and pain, generating different self-statements or ways to cope with stress and pain, and practicing these coping skills in actual situations.

The use of stress inoculations appears particularly important on an outpatient basis, since less external structure and encouragement is available, and the patient is required to rely more on his or her own conceptualization of the treatment process. In one study of chronic tension headache pain, it was demonstrated that outpatient biofeedback treatment using stress inoculation was significantly more effective in reducing pain ratings and general feelings of anxiety and distress than self-monitored relaxation. An interesting aspect of this finding was that both treatments were equally effective in lowering muscle tension in these patients, but the cognitive orientation of the biofeedback treatment appeared to generate greater alleviation of symptoms (Steger and Harper, 1977). The above suggests that the reason inpatient programs have not consistently provided improvement in subjective pain ratings may be a failure to address the cognitive issues directly. Further research is needed before this issue can be resolved.

Based on this brief review, it can be seen that the theoretical and practical strategies in inpatient programs provide the common base for most approaches in the treatment of chronic pain. Graduated increments in activity, systematic fading of medications, in vivo practice in pain tolerance, and anxiety or muscle tension reduction are essential even in the outpatient setting. Since much of the outcome research has been carried out in the context of inpatient operant therapy, the treatment specifics of such a program will be presented in some detail. The following description does not purport to portray the ideal treatment approach, but merely indicates techniques which seem to have been effective.

Evaluation Phase

Chronic pain needs to be evaluated first within the framework of a disease model to check for respondent pain. If clearly identified, respondent pain should be treated within a medical context. A behavioral analysis should be undertaken if any of the following conditions exist: (1) medical assessment fails to reveal physical findings to account for the pain behavior displayed; (2) there are physical findings, but they are disproportionately small in comparison to the severity of the pain behaviors reported or observed; or (3) physical findings are only speculative or inferred.

It is important to note that a behavioral analysis of pain has nothing whatever to say about the extent to which the pain problem is respondent in nature. A behavioral analysis considers the viability of alternative explanations to a disease-model analysis. The primary purpose of such an assessment is to examine the extent to which the patient's pain behavior is controlled by environmental contingencies. Effective behavioral treatment strategies may also be identified by such a conceptualization. Even in a situation where the relationship between pain behavior and reinforcing consequences appears to be strong and pervasive, much or all of the pain behavior may, in fact, still be controlled to a significant degree by physiologically based variables.

The professional who is doing the initial evaluation should remember that, with few exceptions, the patient suffering from chronic pain has been a long-time "loser" in his or her dealings with the health care system. The fact of chronicity means that the health-care system has failed to solve the problem. In addition, as noted by Sternbach, Murphy, Akeson, et al. (1973) many chronic pain patients have such a small likelihood of future gainful employment and successful social adjustment that they are "chronic losers in life" (p. 136): i.e., they are only marginally capable of coping with life's demands except in the protected (although compromised) state of chronic illness. Moreover, many pain patients will have been told, directly or indirectly, that their pain is "in their head" or psychogenic. Such suggestions lead the chronic pain patient to adopt a distrustful attitude toward professionals in general. It is imperative that the interviewer be skillful in establishing an atmosphere of trust and candor, and not make the patient feel that he or she must prove that the pain is "real."

Since so many chronic pain patients view a behavioral assessment as a challenge to the authenticity of their pain, one must deal directly with this issue if accurate information is to be obtained. Clarifying the following points with the patient often helps: 1) Pain should not be considered as real or unreal, but as the experience one feels when one hurts. The assessment assumes that the pain is real and seeks to identify the factors which influence it. 2) Pain, like most other bodily functions and processes, is subject to the influence of learning and conditioning. Pain problems originate as a result of tissue damage, but can be maintained through conditioning (use of a Pavlovian conditioning example is often helpful). 3) Learning and conditioning effects are automatic and are not dependent upon emotional or personality factors. 4) If there is a significant amount of learned or conditioned pain, the patient may be suffering more than necessary and something usually can be done about that. Patients using many analgesics should be helped to understand that chronic and high levels of drug usage often interfere with normal activity and the physiological relearning processes needed to alter chronic pain patterns significantly.

Evaluation needs to identify the relationships between patient behavior (e.g., pain expressions and pain-related behavioral limitations) and environmental events or consequences resulting from this activity or inactivity. In addition to data obtained directly from the patient, highly useful information can be provided by the spouse, whose participation in evaluation should, with rare exceptions, be required. Patient and spouse are interviewed separately as well as conjointly. Data from the spouse provide additional perspective and information regarding the reliability of the correlation between patient behavior and environmental contingencies. With these general strategies and suggestions in mind, the following represent the major issues to be explored in the behavioral analysis of a chronic pain problem. A more detailed and

extensive description is available from another source (Fordyce, 1976, Chapter 6).

TIME PATTERN

The core issue in analyzing a pain pattern involves the activities surrounding the patient and the sequence of these activities in relation to pain behavior. One must discriminate pain which occurs sporadically for varying intervals without relief and is followed by extended intervals of minimal pain from a pain pattern which is relatively steady. The former hardly could be under control of environmental contingencies unless it could be shown that environmental consequences change in correlated fashion with the onset and termination of pain episodes. A simple-minded illustration is a worker who hurts only on weekdays and is pain-free on weekends. In similar fashion, nocturnal patterns are important. Usually the environment "shuts down" at night—this includes the delivery of contingent reinforcement. If the pain does not shut down when the environment does, the problem is more likely respondent in character. However, reported pain-related activity at night always needs to be weighed carefully in terms of possible reinforcement factors. Awakening allegedly because of pain but then always taking medications, emptying one's bladder, or eliciting supportive behavior (such as a backrub) from one's spouse all illustrate potential pain-contingent reinforcement. Consistent time-delays of several hours between specific activities and the onset of pain suggests respondent pain. In general, a rule of thumb is that the longer the interval between the cessation of physical activity and the onset of pain, the less likely the pain is to have an operant component.

IDENTIFICATION OF PAIN BEHAVIORS

There should be specific identification of the sounds, grimaces, and body language used to communicate the experience of pain. A list of verbal and nonverbal behaviors which are consistently emitted to express pain will provide the basis for further analysis of antecedent and consequent events for pain behavior in the latter portion of the interview.

ENVIRONMENTAL RESPONSES TO PAIN BEHAVIORS

Direct reinforcement of pain behavior, indirect reinforcement of pain behavior (through avoidance of aversive activities), and discouragement of healthy activities need to be specified. The pain patient living alone is less likely to be reinforced directly and consistently by a companion's responses. In these cases, a closer scrutiny of the indirect reinforcing qualities of vocational or avocational consequences to pain behavior is indicated.

PAIN ACTIVATORS

This aspect of the assessment concerns activities or situations likely to exacerbate pain behaviors. It is important to obtain exact behavioral descriptions rather than generalities. For example, the response, "Any kind of movement," is insufficient and questioning should be continued until the patient specifies, for instance, "lifting and twisting movements but not bending" as more likely to generate pain. These pain-producing motions should then be related to meaningful activities which are curtailed because of the pain problem. Does the housewife who is vulnerable to "lifting and twisting but not bending" therefore limit or avoid significant amounts of housework? Similarly, does the male housepainter who reports that pain is increased by lifting his arms above his head, limit the amount of work he does? In this way, an estimate of the psychological cost-benefit ratio of pain to activity can be obtained. Also, the likelihood that a patient will increase physical activity above baseline levels can be estimated from a roster of physical activities which exacerbate pain, because the inquiry has identified behaviors previously in the repertoire and therefore more readily established or re-established.

PAIN DIMINISHERS

This portion of the assessment focuses on events or situations likely to decrease pain behaviors. Some activities or behavioral consequences can serve as reinforcers for pain behaviors because when they occur they have the effect of reducing distress.

The extent to which rest and time-out from usual activities consistently decreases pain is an important consideration. Patients who shift from one productive activity to another in order to reduce the pain experience are quite different from those who cease or markedly reduce productive activity and the meeting of responsibilities in favor of rest. In the former case, the probability that pain behavior is under control of environmental contingencies is low; in the latter case, it is somewhat higher, for rest or time-out from aversive events is pain-contingent.

The extent to which medication yields a decrease in pain is also important. The types of medication, quantity consumed, and the time patterns in which they are taken, are critical variables. Consistent and reliable information about medications is often difficult to obtain. Even when accurate reports on the specific type of prescribed medication are provided by the patient, omission of such pain-relieving substances as alcohol, "street" drugs, and home remedies often makes interpretation of medication-usage patterns difficult.

A major issue involving medication relates to habituation or addiction and the extent to which they are taken on a pain-contingent basis. Consistent patterns of medication ingestion (e.g., every 3 or 4 hours, day and night) over extended time periods indicate possible habituation and/or addiction. This situation markedly increases the likelihood that pain behaviors come under the control of medication habit patterns rather than physical causes; thus, the problem becomes one of operant rather than respondent pain. Not infrequently, chronic pain patients who become addicted to pain medications have been observed to display an almost total elimination of pain behaviors following completion of a de-conditioning or withdrawal program which led to minimal or zero consumption rates.

TENSION-RELAXATION

The objective here is to identify the extent to which increases and decreases in tension alter the experience of pain. An assessment is needed to identify whether self-hypnosis, relaxation training, or biofeedback may be appropriate adjuncts to behavioral treatment.

CHANGES IN ACTIVITY LEVEL AS A RESULT OF PAIN

The major issue here is to identify changes in the patient's and spouse's lifestyles after the onset of pain, obtaining a picture of the typical work and social or leisure activities of both patient and spouse across the span of the marriage in order to explore changes in these activities as a consequence of the pain problem. Both vocational and avocational activities are important. If, for example, vocational or homemaking activities have been compromised but not social or leisure activities (assuming rough equivalence in physical demands), the case for operant factors is considerably strengthened. Pain patients who report being unable to sit longer than 15 minutes at a time due to pain, but later sit for 2 to 3 hours in a movie or on a dock while fishing (despite their pain), illustrate the point. Impact of pain on sexual activity is often an important topic. It is not uncommon for significant sexual dysfunction to occur in conjunction with chronic pain; these problems usually require concomitant treatment before the pain problem can be resolved. Pain behavior may help a patient avoid engaging in what is, for him or her, aversive sexual activity.

ADDITIONAL DATA

Psychological or personality test profiles (particularly the MMPI, Minnesota Multiphasic Personality Inventory), tests of intellectual ability or vocational interests, and other data designed to provide a thorough picture of the pain patient can also help plan treatment. Obtaining an activity and medication diary from the patient prior to behavioral analysis provides simple and inexpensive data about actual activity levels. This format has been described previously in some detail by Fordyce (1976, Appendix A).

CONTRAINDICATIONS AND LIMITATIONS FOR AN OPERANT PAIN TREATMENT PROGRAM

Briefly, there are several variables which serve as contraindicators for operant pain treatment. One of these is the case in which

neither social reinforcement nor rest appears to be an effective reinforcer. Other variables which work against success of an operant approach to chronic pain include: 1) A spouse who is uninvolved or unwilling to participate in the program, thereby minimizing the extent to which some of the potentially more significant environmental contingencies can be altered. 2) A patient who refuses to relinquish or to attempt to decrease medication use, when the extent of analgesic consumption suggests addiction or habituation. 3) Pain- or illness-contingent compensation payments which provide a reasonably comfortable existence for indefinite periods of time. The compensation issue should not be oversimplifed, however, for if there are remunerated activities which can be carried out with reasonable competence and gratification, treatment may be quite feasible regardless of the size of the monthly compensation check (Peck, Fordyce, and Black, 1978). 4) The extent to which psychological problems interfere with a patient's ability to engage in a consistent, self-monitored program will also limit the effectiveness of inpatient operant-pain treatment. For example, a severely psychotic patient for whom the core problem is not pain but an emotional or interactional kind of difficulty may generate sufficient complaints of pain to require help, but of a special kind. The core problem must be identified and treated and then the pain problem and its associated functional limitations. Devine and Merskey (1965) examined the frequency with which this mixture of pain complaints and psychological problems is encountered and found that 38% of those coming for help with pain could readily be identified as having significant psychiatric or psychological difficulties. Additional discussion of selection factors for identifying those for whom an operant approach is or is not indicated can be found in Fordyce (1976).

Treatment Phase

Let us consider treatment strategies designed to reduce pain behavior, to increase activity levels, and to retrain the family to provide pertinent environmental contingencies. Two additional treatment goals are important and will be considered first: They are (1) the reduction of excessive health care utilization behaviors—especially those which increase the risk of iatrogenic effects; and (2) the establishment and maintenance of effective well behavior. Reducing health care utilization is cost-effective, of course, and it also helps maintain function. Establishing or re-establishing well behavior is based on three assumptions. First, the antithesis of "sickness" (in this case, pain behavior) is not, inevitably, health or well behavior: the reduction of one is not automatically followed by an increase in the other. Secondly, people who have long been ill are often deficient in their ability to be well. If those gaps in well behavior are not remediated, the person will remain highly vulnerable to resumption of illness behavior soon after treatment. Thirdly, simply stated, people having something better to do seem not to hurt as much—whatever the reason they may have been hurting.

The potential conflict between other treatment approaches and the operant approach should be considered prior to initiating therapy. The difficulties can usually be reduced to two issues. The first concerns alternative treatments which may provide systematic professional activity or attention on a pain-contingent basis. An alternative treatment process should not begin because of a patient's display of pain behaviors nor be omitted due to their absence. A second and related issue involves the necessity for scheduling and orchestrating to take into account all elements of the pain program and the "other" treatments. Several types of problems can be managed at the same time—and often need be—but someone will be required to monitor treatment components to ensure that the pieces fit together and do not conflict or interfere with each other.

PATIENT AND SPOUSE ORIENTATION

After evaluation has established that a patient is an appropriate candidate for an operant program, it is essential that the patient and his or her family be presented with a clear explanation of the evaluation findings and treatment goals.

In general, the purposes of the orientation can be summarized as:

A. to explain how conditioning effects can become the reason pain behaviors

persist beyond the healing time of the originating injury;

B. to identify treatment goals and specify activities that will be possible at the end of treatment (e.g., employment or no employment, full or part-time work, sexual activities—although perhaps limited to certain positions, etc.); and

C. to describe the procedures by which these treatment goals will be attained.

The following are suggestions for the orientation of a chronic pain patient and spouse which may contribute to more effective treatment.

PAIN AS A LEARNED BEHAVIOR. Note that the patient is experiencing and reporting more pain than is necessary, based on the physical findings, and that a significant amount of the suffering experienced is the result of learning or conditioning. This is not a matter of whether the pain is "real" or not; suffering is real. The heart of the matter is what maintains the suffering.

INCREASING ACTIVITY AND PHYSICAL ENDURANCE. Clarify that one goal of treatment is to increase gradually activities and physical tolerance, starting at or below current activity levels. One can next introduce the concept of working-to-quota rather than -to-tolerance. (In the operant approach, goals and treatment steps are, of course, based on physician recommendations concerning safe limits for each patient.)

PAIN MEDICATION AND THE PAIN COCKTAIL. One should explain thoroughly the reasons and methods for control of pain medications in an operant program. Explain to the patient and spouse that pain medications will be reduced gradually. Explain how and why this will occur. Reassure the patient that at no time will his or her medication be abruptly altered or discontinued, and that false or placebo medications will not be used. Explain that analgesics will be given on a time-contingent basis and that the active ingredients will be delivered in a color-and-taste-masking vehicle.

ATTENTION AND SOCIAL REINFORCEMENT. Special note should be made of the way in which staff will respond to expressions of pain. It is helpful to point out that everyone is sensitive to the reactions of others and that concerned staff around a pain patient often may have fallen into the trap of letting their responsiveness become pain-contingent, thereby providing inadvertent support for the behaviors they wish to help the patient diminish. An important aspect of treatment is to turn that around. One can point out that treatment staff will diminish attention and social support to pain behaviors and will respond instead to increases in exercise, activity, and effective involvement. A distinction should be drawn between ignoring pain behavior and being socially nonresponsive to it. Furthermore, if the patient feels that some significant pain-related development has occurred during the treatment program, discussion with his or her physician will always be possible.

STRENGTHENING WELL BEHAVIOR. Finally, one should explain that treatment focusing only upon reducing pain behaviors is insufficient to generate long-term improvement. It is essential to increase physical activity, exercise tolerance, and appropriate well behavior including, as indicated, vocational or social pursuits. It also is generally desirable to focus on the gaps in a person's social skills or "well behaviors" which need to be bridged to reach long-term treatment goals.

It is helpful to note that the initial phase of treatment is often difficult and how well it goes will depend on the involvement of the patient and on effective support by the family. Treatment can proceed only after both patient and spouse have considered all the issues (e.g., medication decreases, activity increases, return to employment, etc.) and have actively decided to participate in the program.

MANAGEMENT OF MEDICATION

PAIN MEDICATION. This section describes the management of pain medication for those patients who demonstrate addiction, habituation, or a history of previous heavy medication use.

The patient is instructed to bring his or her medications to the hospital when admitted. If injectable medications are being used, these are shifted to an oral form. For a period of 2 to 5 days, medication usage is prescribed on a *prn* or "as needed" basis, and the patient is instructed to take whatever amounts seem necessary. The only constraint in this procedure is medical

prudence, to ensure that the patient does not ingest harmful amounts of medication. A significant difference exists between a detoxification procedure and the deconditioning procedure to be explained in this section. If toxicity due to medication is evident, initial detoxification must be provided before an adequate evaluation of the pain problem can be made and a decision on preferred treatment-approaches reached. If the treatment choice is an operant approach, information from baseline observations prior to detoxification can be used as the starting point for a more deliberately paced deconditioning program. Details on methods and conversion tables describing equivalencies for shifts in medications can be found in Halpern (1974).

The key to an effective medication consumption *prn* baseline is an accurate account of the amount taken. What type of medication, the dosage level, the number of times taken per day, the interval between doses, and the total medication over a 24-hour period are required to determine the initial level of medication. Based on the initial baseline evaluation, a pain cocktail is prescribed. This cocktail consists of a color-and-taste masking vehicle (e.g., cherry syrup or glyceryl guaiagolate-robotussin) administered orally so that each dose consists of the active agents plus sufficient vehicle to total approximately 10 ml.

The success of the approach depends on exacting promptness in delivering the pain cocktail at the prescribed times during the first 24 to 48 hours of the regimen. Most heavy medication users have long experienced reluctance on the part of health care professionals to meet their medication needs. It is critically important to overcome that fear by meticulous adherence to the prescribed schedule during those first crucial hours. Furthermore, the patient needs to be reassured that the 24-hour total of medication will match or slightly exceed what he or she had been taking during the *prn* baseline period. Finally, it is imperative that the cocktail be administered at consistent time intervals around the clock; in this way the administration of the cocktail is time- rather than pain-contingent.

FADING ACTIVE INGREDIENTS. There are two concerns in fading the active medications. One is to eliminate or decrease significantly the addictive or toxic agents; the other is to avoid side effects from acute or rapid withdrawal (e.g., seizures, severe emotional stress, acute respiratory embarrassment, or depression). Another objective is to provide opportunities for the patient to re-establish alternatives to excessive medication use, in a gradual and systematic way. Crash programs which replace active ingredients with methadone and fade the ingredients at the fastest possible rate may fail to provide for the relearning aspects of treatment.

From clinical experience, it takes approximately 7 to 10 weeks to bring relatively high medication levels down. Fading need not necessarily occur at the same rate for each medication. The general pattern is to change active ingredients approximately once every 7 to 14 days in equal decrements so that the amount of active ingredient in the cocktail will approach zero in 7 to 10 weeks. An example of pain cocktail is provided in Table 6.1.

It is the exceptional chronic pain patient for whom muscle relaxants or tranquilizers are of continuing help. Usually, when they have been consumed in conjunction with narcotics and/or barbiturates, they can be eliminated, following baseline observations. Depression can serve to reduce the effectiveness of a program. Regardless of whether the patient has been taking antidepressant medication, as observed in the evaluation process and from pretreatment diary data, it is often wise to add such a component to the pain cocktail. Amitriptyline (Elavil) and doxepin (Sinequan) are commonly used effective antidepressant ingredients. When used, they should also be given on a time-contingent basis. Antidepressant agents need not be tapered during the medication deconditioning treatment phase and can be maintained at therapeutic dosage levels throughout the treatment program. This should be periodically re-evaluated. Tapering of antidepressant medication should begin when the patient has started to engage in post-treatment target behaviors anticipated to be reinforcing.

LONG-TERM MAINTENANCE AND FADING OF PAIN COCKTAIL REGIMEN. The consumption of active ingredients in the pain cocktail may not reach zero at the end of the inpatient treatment phase or may never

Table 6.1 Sample Pain Cocktail Regimen*

Inpatient days		Pain cocktail format
1–6	*Baseline:*	Patient reports preadmission pattern of "... one or two of the 50-mg tablets of Demerol two or three times a day, as needed, at home." *Physician orders to nurse:* "May have Demerol, *prn* pain, not to exceed three 50-mg tablets every 3 hours. Carefully record amount taken." *Analysis of baseline data:* Patient averaged 600 mg of Demerol per 24-hour period, at average of 3- to 4-hour intervals between requests.
7–9	*First cocktail*	
	℞ *to pharmacists:*	Demerol, 1920 mg Bevisol, Plebex, or other liquid B complex, 12 ml; cherry syrup qs 240 ml
	Sig:	Pain Cocktail, 10 ml po q3h, day and night, *not prn*
	Nursing order:	Pain cocktail, 10 ml po q3h, day and night, *not prn*
10–12	Since contents of the pain cocktail are not on the label, a copy of the prescription must be kept in a separate pain cocktail book. Decrease each daily total by 64 mg, 1/10 or original amount. A 3-day ℞ is decreased by 64 × 3 or 192 mg.	
	℞ *to pharmacists:*	Demerol, 1728 mg Bevisol, Plebex, or other liquid B complex, 12 ml; cherry syrup qs 240 ml
	Sig:	Pain cocktail, 10 ml po q3h, day and night, *not prn*
	Nursing order:	Pain cocktail, 10 ml po q3h, day and night, *not prn*
13–15	℞ *to pharmacists:*	Demerol, 1536 mg Bevisol, Plebex, or other liquid B complex, 12 ml; cherry syrup qs 240 ml
	Sig:	Pain cocktail, 10 ml po q3h, day and night, *not prn*
	Nursing order:	Pain cocktail, 10 ml po q3h, day and night, *not prn*
16–18	℞ *to pharmacists:*	Demerol, 1344 mg Bevisol, Plebex, or other liquid B complex, 12 ml; cherry syrup qs 240 ml
	Sig:	Pain cocktail, 10 ml po q3h, day and night, *not prn*
	Nursing order:	Pain cocktail, 10 ml po q3h, day and night, *not prn*
19–21	℞ *to pharmacists:*	Demerol, 1152 mg Bevisol, Plebex, or other liquid B complex, 12 ml; cherry syrup qs 240 ml
	Sig:	Pain cocktail, 10 ml po q3h, day and night, *not prn*

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* The assistance of Barbara J. DeLateur, M.D., in preparing the pain cocktail regimen sample and the related discussion is gratefully acknowledged.

Table 6.1 (Continued)

	Nursing order:	Pain cocktail, 10 ml o q3h, day and night, *not prn*
22–24	℞ *to pharmacists:*	Demerol 960 mg Bevisol, Plebex, or other liquid B complex, 12 ml; cherry syrup qs 240 ml
	Sig:	Pain cocktail, 10 ml po q3h, day and night, *not prn*
	Nursing order:	Pain cocktail, 10 ml po q3h, day and night, *not prn*
37–39	℞ *to pharmacists:*	Demerol 0 mg Bevisol, Plebex, or other liquid B complex, 12 ml; cherry syrup qs 240 ml
	Sig:	Pain cocktail, 10 ml po q3h, day and night, *not prn*
	Nursing order:	Pain cocktail, 10 ml po q3h, day and night, *not prn*

(Maintain patient on vehicle for 2 to 10 days; if all is going well, inform patient and ask if continuation of vehicle is desired.)

reach zero, requiring the patient to maintain an indefinite pain cocktail regimen on an outpatient basis. Continued fading of medications on an outpatient basis is usually not difficult and tends to occur more frequently when there is a significant respondent element to the pain problem.

Chronic pain patients, like everyone, may occasionally have acute pain episodes, either respondent in nature as a result of some wound or trauma, or periodic resurgences of the operant pain problem. The referring physician should receive guidance on how to deal with such episodes. If some trauma, unrelated to the original pain problem, produces pain (e.g., wound, infection, sprain, etc.) and analgesics seem appropriate, administration should be on a time-contingent and time-limited basis. The number of days of medication should be based on the judgment of the physician as to the natural life of the wound or infection, etc., and its associated pain. Re-emergence of an operant pain problem can be handled in essentially the same way. A pain cocktail regimen can be reinstated, starting with a minimal amount of active ingredients and with a set schedule for fading to a termination point.

NON-PAIN MEDICATION MANAGEMENT. Many chronic pain patients are taking medications which are unrelated to the pain problems; e.g., hormones or vitamins. These can be handled independently from the pain cocktail procedure and delivered as prescribed in the usual fashion. The exceptions are tranquilizers or sedatives, which should either be eliminated or incorporated into the cocktail.

TERMINATION OF PAIN COCKTAIL AND SPECIAL PROBLEMS. The patient should be informed when active ingredients in the pain cocktail reach zero. It is generally advisable to wait for 1 or 2 days after this has occurred to allow adequate demonstration of functional performance in the absence of analgesics. Conditioning and its effects are potent. The ritual of medication usage may itself have significant conditioned properties for the patient. Each patient should, therefore, be offered the option of continuing with the cocktail (vehicle only, with no active ingredients) for a period of time, should that be desired. A fading regimen for the vehicle may then be worked out.

INCREASING EXERCISE AND ACTIVITY LEVELS

In contingency management treatment of pain, whether operant or respondent, exercise has a particularly important role. Exercise improves physiological tone and strength and can increase functional abilities. Exercise has the additional characteristic, in nearly all cases, of being incompatible with pain behavior. Activity levels usually diminish in response to competing pain behaviors. In addition, performing in-

creased exercise tends to elicit more helpful responses from the environment than those elicited by displays of pain behavior. Family members who have been consistently discouraging activity or exercise have an opportunity to learn that activity is "safe" and can now rehearse ways for reinforcing activity rather than discouraging it. Finally, exercise and activity is well behavior in its own right.

SELECTION OF EXERCISES. Among the criteria for selecting exercises are relevance to pain (i.e., the activity produces an increase in pain behavior following a few repetitions), contribution to physical conditioning, or rehabilitation for a specific functional weakness. Exercises should be measured in amount performed rather than time units (e.g., walking a set distance and not a number of minutes). Exercises should be visible, easily monitored, and relevant to post-treatment activities. Exercises are medically prescribed with medical and physical limits set for each patient individually. The following is a list of typical exercises and activities for low back pain patients:

Exercise	*Units of Measurement*
1. Riding a fixed bicycle	0.10 miles
2. Walking	50-m laps
3. Climbing and descending stairs	Flights of x steps each
4. Pelvic tilts	Repetitions
5. Hip extension	Repetitions
6. Hip abduction	Repetitions
7. Turkish knot tying while standing	Rows
8. Homemaking (cooking, sewing)	Time‡

These activities are prescribed either in physical therapy or occupational therapy, and comprise the majority of the patient's activity treatment while in the hospital.

IDENTIFYING EXERCISE QUOTAS AND INCREMENTS. Once exercises have been chosen, baseline levels need to be identified. Twice-daily physical and occupational therapy sessions can begin for approximately 3 to 6 days. The patient is instructed to "work to tolerance" at each prescribed activity or exercise. "Tolerance" is explained as meaning that the activity should be performed without interruption until terminated by pain, weakness, or fatigue. It should be made clear that the patient is free to decide when to stop. Baseline trials should be observed by a therapist who records performance: e.g., number of repetitions. Baseline exercise or activity levels can be assessed on an outpatient basis as well, using the spouse or other person as observer and recorder. Following baseline evaluation, the exercise values obtained are reviewed and initial treatment quotas are established.

A primary objective of the initial treatment quota is to ensure success during early sessions of treatment. Initial quotas which fail to be reached or are followed immediately by increased displays of pain, weakness, or fatigue are, by definition, too high and need to be readjusted immediately. With patients who report significant pain without exercise, initial quotas are selected to avoid increases in pain. There is no set formula for initial quotas. One way is to average the baseline performance for each exercise and set the initial treatment quota approximately 10% below. The guiding principle in setting the initial quota is to select the highest value which the patient can meet. (Also, subsequent increments should be manageable without significant difficulty.) When in doubt, set a lower quota.

The patient is instructed that once initial baseline levels and initial quotas for exercise and activity have been set, he or she will be expected to engage in physical therapy twice daily and that these activities will be gradually and systematically increased. A judgment must be made as to how rapidly to increase the amount of exercise. There is no simple formula to compute this. The guiding principle is to increase at a pace that promises a high probability of success over many exercise trials. In the inpatient setting, ongoing observation by the therapists is helpful in setting realistic rates of increase; in the outpatient situation, rates of increment should be set very conservatively and frequent monitoring or progress is essential to ensure accuracy and effectiveness.

REINFORCEMENT FOR EXERCISE AND ACTIVITY. The quota system provides rest con-

‡ A necessary compromise, but this activity is usually not begun until considerable treatment progress has occurred.

tingent upon and immediately following the exercise activity to be strengthened or increased. Rest intervals may usually be brief. Compliance is best encouraged through social reinforcement and other reinforcers available in the treatment setting.

One method to assist both inpatient and outpatient adherence is to display graphs of performance and quotas completed. With appropriate quotas and increments, the patient and spouse will see steady improvements in performance. A graph indicating initial baseline levels and several readjustments is provided in Figure 6.1 (from Fordyce, 1976). The visual representation of success is in itself encouraging.

FAILURE TO ACHIEVE QUOTAS. Patients will occasionally fail to meet quotas. For the first one to three consecutive failures, the therapist is instructed not to comment specifically but simply to record the amount the patient completed and make some matter-of-fact statement like, "Okay, see you this afternoon." Quotas are continued at the previous level during subsequent sessions. Under no circumstances should the therapist give the patient encouragement. If failure persists beyond the one to three consecutive times, the patient is told that quotas will be dropped below the failure threshold and recycled. Occasionally, failure will persist even after recycling and re-evaluation. In these instances, it is possible that too high a quota has been set for the patient and that reassessment is necessary. Ceilings should be set on all exercises. This is primarily a medical decision. For physical therapy exercises, typically, 20 to 25 repetitions is appropriate; with respect to walking, 1.5 to 2.0 miles twice a day is often a good upper limit.

Repeated and consistent failure, despite medical opinion that the ceiling for a particular exercise is not excessive, may indicate that the patient is simply not a good candidate for the operant approach. At this point, the patient can be given the choice of continuing training at the current quota or of terminating the program. If, after lowering the quotas to below the failure threshold, the patient continues to fail, treatment should be terminated, since it is apparent that the reinforcers available are not effective for that particular patient.

PROGRAMMING PAIN-RELATED TREATMENT PROCEDURES

The strategy for using other pain-related therapies is identical to the one described for non-pain medical procedures and med-

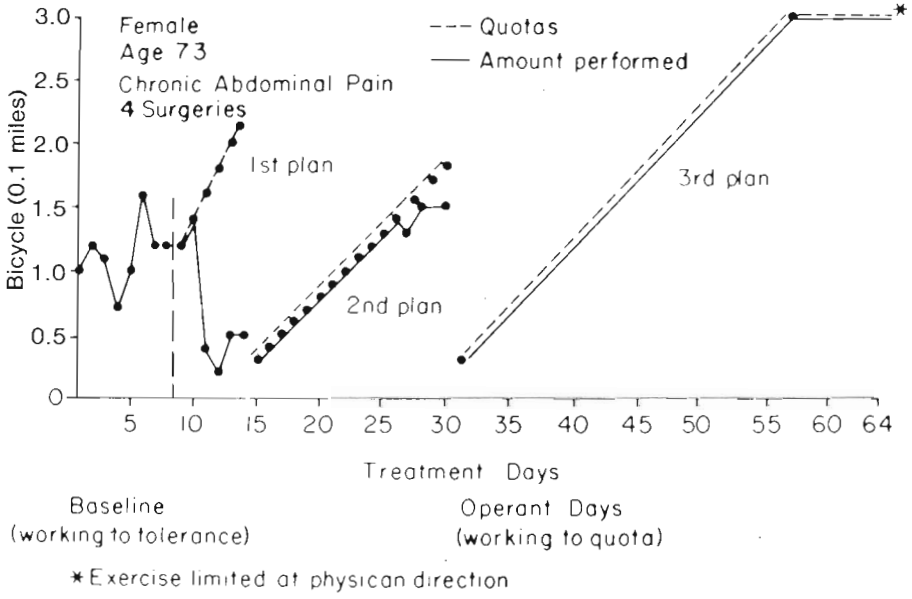

Figure 6.1. Quota adjustments to meet quota failures. (Reprinted by permission from Fordyce, W. *Behavioral methods for chronic pain and illness*. St. Louis: C. V. Mosby, 1976.)

ications for these conditions should be prescribed separately from the pain cocktail. Alternative pain-related treatment procedures may be considered (e.g., ethyl chloride spray, nerve blocks, heat or massage, transcutaneous stimulation, muscle relaxation training, or other procedures), and these are often less costly and less time-consuming than a fully programmed contingency-management approach. If successful, so much the better. If the approach provides significant help but not total relief (e.g., electromyographic biofeedback helps reduce headache pain but does not alleviate back pain sufficiently to allow increased activity level) then the operant program may need to be integrated with it. One underlying principle remains the same: specialized attention and medical procedures should not be prescribed on a pain-contingent basis, but when deemed necessary, should be provided in a time-contingent and consistent manner.

Conclusion

This chapter has reviewed major theories of etiology in chronic pain. It should be evident that pain, as a concept, clearly involves more than a sensory-receptor response system for nociceptive stimuli and physiological sensations. Pain also involves behavior and environmental consequences as well as attitudes and expectations based on prior experiences with pain. In the particular case of chronic pain, these variables—pain behaviors, environmental contingencies, and attitudes or expectations—often play major and even predominant roles in the manifestation of clinical pain. The importance of moving beyond the confines of a simple biomedical or disease conception of pain is also supported by the high incidence of continuing pain problems following standard treatment derived from the biomedical perspective.

Methods and a rationale for a multimodal, behaviorally based approach for treating and managing chronic pain have been set forth. The essential elements are:

1. Recognition that chronic pain rarely can be adequately understood or treated solely within the confines of a biomedical perspective;
2. Designation of comprehensive evaluation procedures encompassing medical, phychological, occupational, environmental, and behavioral assessment of the factors contributing to the current pain behavior;
3. Coordination of treatment which focuses on decreasing pain behavior as well as reliance upon medical services and on increasing well-behavior; and
4. Conduct of follow-up designed to encourage self-monitoring and environmental support for treatment gains.

Finally, further research is called for, to evaluate comprehensive treatment programs and to determine the effectiveness of various components. For example, it has been demonstrated that chronic tension-headache patients do not require intensive inpatient approaches, while chronic low-back pain patients may not respond well to an outpatient approach. The accurate assignment to different therapies will only be possible when research has been completed to provide information about the relative importance of components dealing with cognitive factors, physical exercise, anxiety and muscle tension reduction, in vivo pain-tolerance training, and psychotherapy as well as disease variables in different populations of chronic pain patients.

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