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AN INVESTIGATION INTO SOMATIC PAIN

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SECTION I

OUTLINE OF THE RESEARCH

The present study is an investigation of the theory that some muscular pains, so-called fibrositis, muscular rheumatism, etc., are of "psychogenic" origin.

That psychological factors are involved in the causation of muscular pain is supported by considerable evidence. There is the relative absence of tissue pathology in these muscular pains; there is the fact that a muscle is almost, if not quite, painless to direct muscle stimulation, i.e. cutting, pushing needles through, burning, scratching etc. (although it may become a source of pain under other conditions); there is the unanimous opinion that the main symptom in muscular pain is muscle spasm; and finally there is the empirical observation that patients with muscular pains located in similar structures display similar behavioural patterns and that pain "fluctuates" from day to day in accordance with fluctuations of life situations.

All this supports the proposition that a behavioural investigation of muscular pain would be best suited to

solve many problems, about which numerous speculative theories have been advanced.

In order to make it possible to formulate a hypothesis and submit it to a scientific test, two preliminary investigations were carried out:

1. PHYSICAL INVESTIGATION

The main intention was to find out:

(a) whether muscular pain was confined to a particular muscle or muscle group and not merely to ascribed areas of no fixed boundaries, e.g. lumbago, (pain in lumbar region) brachial neuritis, (pain in shoulder) pain in the chest wall, etc.;

(b) what the relationship was between muscular pain and muscular tension;

(c) whether pain could be "removed" by relaxation and experimentally reintroduced by measures which would cause the muscle to tense up.

This investigation was carried out on a sample of 96 patients and it was found that all the above propositions had a positive bearing on muscular pain.

2. PSYCHOLOGICAL INVESTIGATION

Here the main intention was to examine:

(a) the relationship, if any, between muscular pain and personality make-up;

(b) the relationship between site of pain and pertinent pattern of behaviour (overt and covert) of the individual;

(c) the probable motives or drives leading to such a pattern of behaviour;

(d) the possibility of establishing a control group. This control group would receive different treatment from the experimental group and in the comparison of the degree of recovery obtained by differential treatment in these two groups, sufficient evidence would be supplied for or against the assumption that psychological factors were involved in muscular pain causation.

This investigation was carried out on a sample of 88 patients and the results showed strong evidence that psychological factors were present when muscular pain occurred.

The clinical findings from these two investigations were conceptualised and a hypothesis and a working plan for testing it were elaborated.

The present investigation was primarily a psycho-

physical investigation but it differed from the prevailing psycho-somatic approach in breaking with the tradition of mind-body dualism. The individual was instead regarded as a biological organism operating in, and by means of, an individually-determined physical and social environment.

The postulated aims of this inquiry were:

- (a) to establish the most probable relationship between muscular spasm (a symptom widely observed) and muscular pain;
- (b) to find out what stimulus was most likely to bring about this "involuntary" muscle contraction;
- (c) to examine the relationship between muscular pain and life situations;
- (d) to make inferences as to the underlying neuro-physiological mechanisms involved in muscular pains.

As the investigation was based on clinical material, the prevailing method had to be the clinical method - a procedure directed towards the individual and his "problems". This method seemed to be a suitable basic method for obtaining the necessary information as to when and under what conditions behaviour occurs. (Watson, 1951)

and Hadox, 1953).

Thus the major part of this investigation was individual-centred; the individual was examined in his everyday milieu, and the emphasis in this examination was on the relationship between present behaviour of the total organism and present environmental conditions.

The clinical method was, however, supplemented by the experimental method in so far as muscular pain itself was concerned (e.g. localization of pain, experimental removal of pain and experimental reintroduction of pain), and by statistical methods which provided more precision in reaching conclusions.

The obtained results confirmed the assumption that muscular pain may constitute a behaviour disorder, although physical factors cannot be excluded from the aetiology of pain. It is the interplay between behavioural and physical factors that is responsible for muscular pain occurrence.

In addition this investigation has thrown some light on the neuro-physiological factors involved in

muscular pain and has also furnished some practical information as to the most successful approach in treatment of muscular pain.

STATEMENT OF PROBLEM

The hypothesis tested was the following: that some muscular pains, described clinically as fibrositis, muscular rheumatism, myositis, myalgia, brachial neuritis, pleurodynia, etc., are evoked by muscular tension brought about by exertive behaviour.

This hypothesis was a further elaboration of the generally accepted theory known as the reaction hypothesis, which states that all forms of behaviour, whether muscular, glandular or mental, are reactions to definite stimulation. According to this theory behaviour is acquired only through some kind of reaction to a situation or stimulus (Andrews, 1948).

The hypothesis tested was concerned with the major question and two subsidiary hypotheses. The major question was the nature of somatic pain itself, and the two subsidiary hypotheses were:

(1) that muscular pain is evoked by muscular tension (contraction);

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STATEMENT OF PROBLEM

The hypothesis tested was the following: that some muscular pains, described clinically as fibrositis, muscular rheumatism, myositis, myalgia, brachial neuritis, pleurodynia, etc., are evoked by muscular tension brought about by covert behaviour.

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The hypothesis tested was concerned with one major question and two subsidiary hypotheses. The major question was the nature of somatic pain itself; and the two subsidiary hypotheses were:

(1) that muscular pain is evoked by muscular tension (contraction);

(2) that muscular tension is the result of prolonged covert behaviour.

By covert behaviour is meant a form of behaviour which cannot be observed easily by a casual onlooker; even though it is not seen, it is present, being simply reduced in magnitude to small muscular contractions of which even the subject himself may be unaware.

In order to consider the main question and collect evidence for or against the two subsidiary hypotheses, the investigation was directed towards the examination of the following points:

1. Data concerning the pain itself:
 - (a) quality and quantity of pain;
 - (b) localization of pain and muscular structures involved;
 - (c) time of occurrence;
 - (d) experimental study of life situations and the occurrence of pain;
 - (e) under what other condition pain became more or less severe.
2. Degree of displayed muscular tension and the relationship between tension and pain.

3. Motives and drives as stimuli eliciting muscular contraction, with particular consideration given to:

(a) the personality make-up and especially the attitudes, feelings and pertinent behaviour patterns of the individual;

(b) the recent life situations which had a distressing effect on the individual and served as the main stimulus for action;

(c) the degree of disruption of behaviour of the individual as the result of the operation of environmental stress;

(d) the individual's attempt to cope with the environmental stress situations which have been forced upon him (adjustive behaviour);

(e) the individual's bodily preoccupation.

If the pain was caused by muscular contraction as an implicit sustained response under stress to a specific noxious environment (internal or external), it seemed logical, that through desensitization of these subjects from such acquired behaviour patterns, and by comparing them with a control group of patients with the same complaint, but treated differently, an

SECTION III

objective measure could be obtained for or against the hypothesis. Hence a "self-control" group was instituted.

REVIEW OF THE PERTINENT LITERATURE

THEORIES OF PAIN

From time immemorial the problem of pain has occupied the thoughts of philosophers, theologians and physicians.

During the time of Aristotle, the sensation of pain was considered to be the manifestation of an emotion, a "qualis", or a feeling state of the soul and it was appraised as the equivalent of "unpleasantness". Pain therefore was not grouped with the five senses as it was not referable to any quality of an external object. Its position in the fields of psychology and physiology remained an uncertain one. This fact is prominent in the discussions of the history of pain concepts (Dallenbach, 1939) and of sensation in general (Boring, 1943), which deal with the various hypotheses that have been advanced to elucidate the pain experience.

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Over the years the concept of sensation had slowly

been undergoing a fundamental change. The important discoveries of Charles Bell in 1827, regarding the functions of the dorsal roots of the spinal nerves as distinct from those of the ventral roots, initiated a period of a century and a half of diligent search for the understanding of sensory phenomena. Bell pointed out the relationship now known as the Bell-Magendie Law, viz., that the function of the dorsal roots is sensory and that of the ventral roots is motor. The recognition of this fundamental division of the nervous system established for sensation an anatomical basis as real as that of motor function.

This discovery led to much experimentation by psychologists, physiologists and physicians, and it became possible from the time of von Frey (1894) (through his histological studies of cutaneous nerve endings), to apply quantitative methods of psychological study.

Receptors for various sensations were described. The receptors for pain were found to be free nerve endings terminating in fine fibrils; for cold, special large bulbous endings described by Krause; for warmth,

the tightly coiled endings identified by Ruffini; and for tactile sensation, networks of fibrillae contiguous with the hair follicles. These formulations remain in many contemporary text books.

While such investigations at the end of the 19th century, and beginning of the 20th century were being carried out, three concepts of the nature of pain stood in mutual opposition.

The first was the older emotion theory. This dated from the time of Aristotle and supposed pain to be a phase of unpleasantness, an emotional state initiated by some sensation. Secondly, there was the concept originally put forward by von Frey that pain was a sensation with its own distinct central and peripheral sensory mechanisms. Thirdly, there was the so called intensive theory originated by Goldscheider in 1894 based upon the concept that pain was the result of intensive stimulation of any sensory equipment.

Recently, support of the intensive theory, has been offered. Nafe (1934) has called attention to the existence of a possible relationship between the state of contractions of the smooth muscles as induced at

various levels of temperature. The sensation evoked appeared to be dependent upon the degree of contraction of smooth muscles. This contraction, in Nafe's view, leads to a stimulation of the adjacent nerve endings. With an increase in vigour of muscle contraction, a corresponding increase in stimulation of the nerve endings appears to occur. This relationship results in a continuum of the quality of sensation from warmth to heat to pain - all mediated by one and the same peripheral neural equipment. Pain, Nafe inferred is associated with the most intense stimulation and is the result of a summation of effects originating in intense smooth muscle contractions integrated at the thalamo-cortical level. He also implied that pain is akin to emotion and not a sensation, in this way combining the "intensive" with the "emotion" theory.

Recent investigations carried out by Hardy et al, (1952) employing psycho-physical methods, analgesics and inferences from physiology, support the old view that the feeling state may perchance be the most relevant aspect of pain to the one who suffers. Thus a fourth theory has been put forward which holds that a pain experience is composed not only of pain sensation but of

associated sensations and of emotional and effective states as well. Every sensation of pain (ache, prick, burn) is thus viewed as accompanied by a more or less predictable pattern of associated sensations (such as heat, cold, pressure) and feeling states (e.g. anger, fear, pleasantness, unpleasantness), the sensory result being the total pain experience for a particular individual. Hardy's concept also takes into account the fact that important bodily reactions to noxious stimulation themselves entirely below the level of conscious activity, may contribute new sources of noxious stimulation and pain. But no explanation as to the involved mechanism is given.

Although by definition the pain experience must include pain sensation and associated phenomena, Hardy and his associates during their thirteen years of pain investigation gave the associated phenomena only secondary consideration. Pain to them was a sensation, mediated by specialised neural equipment (free nerve endings) and the alteration in tissue by damage was the assumed stimulus.

It is generally agreed that a successful scientific

attack on the problem of sensation is bound to be psycho-physical. The main aim of this approach is to show how sensation depends on stimulation and to define the quality and quantity of such stimulus (Boring, 1952).

Here two fundamental questions arise:

(1) What is the "true" stimulus to pain with the analogous meaning we have when we say that wavelength is the true stimulus to hue? (How can, for instance, radiant heat be a true stimulus for pain when it is variant for a constant intensity of pain? A little heat for a long time is as effective as more heat for less time).

(2) What is the "true" stimulus to somatic pain provocation? (Is it the same as for cutaneous pain, or is it different?).

Attempts to answer these questions have been made by many investigators. Lewis (1942) stated that deep pain was due to a "P" factor, a product of muscular contractions in absence of blood flow. Schumacher (1943) thought that pain was produced by a "pain substance" which was liberated from damaged cells, thus lowering the threshold by altering the chemical environment of the nerve endings. Potelumas et al. (1949),

however, were able to demonstrate that tissue injury and the "products of tissue damage" do not inevitably result in lowering of the pain threshold, as many instances of such "tissue damage" never result in secondary changes of the tissues involved. Hardy et al (1952) favoured the notion that pain is aroused by "noxious" stimulation, that is, by the destruction of tissue, yet they were in serious doubt whether tissue damage was an adequate stimulus to pain. They remarked that on somatic and visceral structures the mechanical stimuli of compression and distension are most generally effective, while local electrical or thermal stimulations of the gut, even so strong as to destroy tissue are ineffective in eliciting pain. Hardy thought that the sparse distribution of visceral afferent fibres and endings mediating pain accounted for this effect.

The investigation of cutaneous pain has taken a leading place among investigations of sensation.

In experimental situations in which cutaneous pain is provoked various stimuli are used e.g. electrical, chemical, mechanical and thermal. That the stimulus always comes from the outside of the body appears to be

unanimously accepted. (Hardy et al, 1952).

There is, however, considerable doubt as to what constitutes a "true" stimulus to pain. Doubt on this subject has been recently expressed by Boring (1952) who questions how it is possible to translate thermal effects into mechanical, electrical or chemical effects and why "cold" is as effective as "heat" in pain provocation.

Thus the problem of cutaneous pain appears to leave us with many unanswered questions even after 170 years of intensive laboratory experimentation and investigation.

Similarly the question of deep pain and especially muscular pain, (the subject of the present study) is still an open one. Because experimentation with muscular and visceral pain in laboratory conditions is extremely difficult, this problem has been left to the clinicians. Their starting point is generally found in the outcome of studies of cutaneous pain, although such outcomes may not be particularly illuminating.

In general, the clinician is concerned with three

questions (Ogilvie, et al 1952):

(1) What is the course of the pain fibres from different parts of the body to the brain?

(2) What are the causes of pain in their diagnostic significance?

(3) What are the most effective methods of alleviating pain?

The clinical literature on muscular pain is extensive but the offered explanatory theories are conflicting.

It is generally assumed that free nerve endings, with a segmental distribution throughout the body, are the receptors for pain and that these endings are usually very sensitive to any vigorous mechanical stimulation. But it is a well known fact that certain structures of the body (e.g. liver, spleen, intestines, uterus etc.) are not pain sensitive to stimuli which are commonly productive of pain in the skin, such as pricking, cutting, pinching, burning, while a pull from traction or rapid distention or excessive contraction may be painful.

With regard to somatic muscles, a needle may be

passed through a muscle, or a muscle may be incised, almost if not quite painlessly (Lewis, 1942), but very distinct or severe pain may be provoked by injecting 2 to 3 c.c. of 6% saline solution or induced by working the muscle under ischaemic conditions (Lewis, 1942).

To test the sensitivity of muscular tissue, a small experiment was carried out as a check on certain aspects of the theories under review. Twelve subjects, consisting of physiotherapists and nurses took part. A hypodermic needle was inserted into the Deltoid and Triceps. Before the needle was inserted the subjects were put at ease and it was explained to them that after piercing the skin the needle would be pushed into the muscle, and they were to report what they felt. Three insertions into each muscle were made at the same point, without withdrawing the needle completely from the skin. All the subjects reported a pricking sensation when the skin was pierced. While the needle was being inserted into the muscle itself, eleven of the subjects reported no pain. One subject felt pain on one insertion.

There also seems to be considerable empirical evidence that muscular tissue is not pain sensitive in

the same way as skin. A prominent example of this is found in the amount of pain present in advanced bed sores. These sores are sensitive to scratching or pressure only on the edges of the wound where the skin is intact. The centres with their open muscular tissue are insensitive to pain.

If these facts are true, why is it that under certain other conditions a muscle becomes pain sensitive and indeed is a source of many human ailments covered by the omnibus name of muscular rheumatism - meaning pain of unknown aetiology.

One of the oldest theories on the aetiology and morbid anatomy of muscular pain was that of Stockman who, in 1920, hallmarked the muscular pains with the so called "fibrositic nodules". He attributed the presence of fibrositic nodules to inflammation. This inflammatory theory has not, however, been substantiated. Some go so far as to say that fibrositis does not exist because biopsy examinations show either lumps of fat or normal muscle. (Ogilvie et al, 1950).

There are three main theories now current: that of increased tension in fatty lobules, that of localized

muscle spasm and that of psychogenic rheumatism. The first theory was put forward by Copeman et al, (1944) as the result of their observations on the similar location of the "trigger points" of fibrositic pain and the basic fat pattern in cachectic subjects. This basic fat, which did not disappear on emaciation, was situated in four areas: in the supraspinatus fossa; along the medial border of the scapula; along the border of the lumbo-sacral muscles; and extending from the region of the sacro-iliac joints along the crest of the ilium. They found that in these areas pain and tenderness often appeared in fevers and after trauma, and that this tenderness later disappeared, but was easily reactivated by minor trauma or infection. These fatty deposits, they assumed, were probably endocrine in nature.

The second theory of localized muscle spasm was suggested by Elliot (1944); using the electromyograph, he showed that tender areas in muscle had continuous discharge of reaction potentials very similar to that obtained with a minimal voluntary contraction. He suggested, therefore, that the pain in fibrositis was the effect of localized involuntary muscle spasm arising

reflexly from lesions elsewhere. He considered that the "nodules" which are commonly felt in fibrositis at the principal sites of pain, may in reality be small groups of muscle fibres which are in spasm owing to irritation of the nerve roots supplying them.

Elliot's concept was widely accepted among clinicians and especially among orthopaedic surgeons. "Slipped discs" became the vogue in diagnosing the cause of muscular pains. But it has to be remembered that pressure on the specialized nerve ending, whose function is the conveyance of pain sensations may naturally cause pain, while the effect of pressure on a nerve root, fibre or trunk is not to produce pain of the type characteristic of "rheumatism", but a "pins and needles" sensation referred to the area of distribution of the nerve (Cyriax, 1947).

The question of "slipped disc" as the cause of somatic pains seems to be at present under revision. Criticism of prevailing traction methods and doubt as to the real existence of "slipped discs" in muscular pain was expressed recently by Rose (1954).

In addition to these two theories, injury is

considered to be a common cause of fibrositis as the result either of a single incident or of repeated strain over a long period. As a rule the discomfort is short in duration unless the strain is maintained by occupational factors. There would seem to be no doubt that exposure to cold, wet, draughts, chilling and sudden changes in temperature can initiate an attack. (Graham, 1954).

The third theory, that of psychogenic rheumatism, was elaborated by Halliday (1937 and 1941). Halliday was the first in this country to point out the relationship between psychological factors and muscular pain. According to him, emotional stress and anxiety states may produce pain, stiffness and limitation of movement. These symptoms are an outward manifestation of inner emotional tension that have been provoked by disturbing external events or conflicts. Halliday also suggested that muscle pain and stiffness may represent symbols which may stand for a mental experience and are, in a sense, a form of body language c.f. spitting when rejecting or holding stiff when disapproving. These symbols, he further suggested, represent what a person perceives, feels, desires or thinks.

Although the psychological theory of muscular pain has been challenged by those who defend the organic theories, its validity has been strongly supported by many authors who consider that the fibrositis syndrome is precipitated by a psychosomatic disorder. This view is supported by the observation that the symptoms tend to come and go with changes in life situations and often disappear when the emotional stress is over. Such a mechanism has long been regarded as a basis for cardiac and gastric complaints, but for some reason it has not been generally accepted in the field of rheumatism (Graham, 1954).

On reviewing the clinical literature on muscular pain it can be said that the main concern of the clinician in this field is the description of symptoms and the pathology, aetiology and the alleviation of the complaint itself. Very little attempt has been made to identify the pain receptors and the nature of the involved stimuli.

S U M M A R Y

From the survey of the literature on the subject of pain, two approaches to the problem appear most

frequently. In the experimental approach in which psycho-physical methods are principally employed, pain is induced in the subject; the nature of the stimulus is described, its intensity is measured, and a definition of the thresholds for pain is formulated. Because of the difficulty of introducing deep (somatic or visceral) pain harmlessly, investigations using the experimental approach are mostly concerned with cutaneous pain only. On the other hand, it has to be realised that experimentally induced pain can give very little information about pain as a clinical entity, because the pain lasts only a matter of minutes and is incapable of producing the signs and accompanied symptoms of a chronic disorder (Harman, 1940).

The other approach is the clinical one. The subject is already experiencing pain and seeks alleviation of his disturbing experience. The clinical approach to this situation tries to establish the causative factors, but more frequently is satisfied with introducing therapeutic remedies. Although it is true that effective treatment must rely on a full understanding of the aetiological factors many "inventions" in the field of therapeutics come from empirical

experience where "trial and error" plays an enormous role.

It appears to be evident that both these approaches have produced limited results. They have not identified the "true" stimulus to pain, nor have they produced sufficient evidence as to what neuro-physiological mechanisms are involved in pain experience. Also, the reason why some organs, non-sensitive to normal pain stimulation, become pain sensitive under certain conditions (either to specific physical or to mental stimulation) has not been fully explained by either of these approaches.

Thus the causative factors of muscular pains still seem to be obscure - so much so, that Lewis (1942) described them as "baffling". Nevertheless, the previous findings cannot be ignored; they have cleared much ground for future investigation and have thrown helpful light on the question of pain in general.

T E N S I O N

The concept of tension although originally a physiological one has been used widely and frequently by psychologists. Notwithstanding this fact there is little experimental evidence for identification of the psychological meaning of this term. (Eysenck, 1953).

The most valuable findings on tension came from Duffy's research (1930, 1932) on emotion and muscular tension. By factorial analysis, using twelve tests measuring tension, Duffy obtained a general factor which she called the "general tension" factor. According to her, tension is a state of preparedness for action, activated by "emotion" through the autonomic nervous system. A state of tonus is produced in the same somatic muscles that would be stimulated to produce the action itself. Her investigations also showed that increases in tension signify an increase in excitation in general, or in that particular type of excitation called "effort". Tension appears to be associated with striving and expectancy and other states in which the organism is exerting, or preparing to exert, increased energy. Without question, excited emotional

states are among those in which such increases in muscular tension are most to be expected. Duffy had, however, some doubts about this latter statement, because tension is aroused not only during emotional states but also during intense mental effort. She also stressed very strongly that her investigation had shown a close relationship between tension and adjustment to the environment. Individuals with higher tension scores tended to be rated lower on stability and degree of adjustment to their environments. Tension, according to her, also frequently found expression in stammering, enuresis, temper tantrums and restless movements of various kinds. Even aspects of health appeared to be related to the characteristic tension level of the individual.

An attempt to appraise individual differences in level of muscular tension was made by Wenger (1943). Using a rating scale to define the degree of muscular tension and various performance tests, he was able to isolate a common factor which he called "muscular tension". Because muscular tension was found to vary from person to person, Wenger suggested that it could be used as an indicator in the assessment of individual

differences.

Muscular tension and irritability was studied by Freeman et al, (1932). They correlated muscular tension with irritability defined by the Cason Common Annoyance Test. The correlation obtained was: $r = +0.49$.

Although the obtained correlation was rather low in this experiment and no significance noted, some relationship was indicated as present between muscular tension and irritability.

Gottschalk et al (1950) gave an account of an experimental test of changes in muscular tension using as a measurement electromyographic records (E.M.G.). Their subjects were put into a stress situation or asked to imagine actual muscular movements; at the same time their action potentials were recorded. The results showed muscular tension present in both situations.

Also using the E.M.G. method, Shagass et al, (1954) were able to show that muscular tension varies with mood. A cheerful mood appeared always to be associated with lower muscular tension whereas a depressed mood tended to be associated with higher muscular tension.

That tension can have a close relationship with pain

was pointed out by Rangell (1953). According to him, pain can occur readily and with a minimal stimulus when an organism is in a "chronic state of readiness for discharge". Such a condition exists in the state of undischarged or dammed up tension.

Animal experiments also furnish evidence that tension is developed in stress situations. If during active movement, the limb of a tetrapod, or the trunk musculature of a fish or snake, encounters an obstacle, the tension in the contracting muscle is greatly increased and is maintained for a considerable time (Lissmann, 1950).

Kubie (1953), taking into account logical, anatomical and physiological data discussed how tensions which originate on the level of psychological experience, convert into somatic disturbances. Although^hhis considerations were purely speculative he expressed the opinion, shared by many physicians who deal with "psychosomatic" disorders, that tensions are the starting point in diseases of which the origin is "psychogenic".

Summing up the question of tension as discussed in the literature, it can be said that tension is a

preparedness for action. It most readily occurs in any situation in which increased activity of the organism is required - either to solve a difficult problem or to cope with a stress situation.

Morgan (1943) discussing varieties of behaviour - whether they are evoked by external stimuli or whether they arise from a need within the organism; whether they are automatic or conscious and voluntary; and whether they are movements of the body as a whole or of a part of a limb in particular, differentiates two kinds of behaviour. One variety is observable and easily detectable, this he calls overt. The other which is unobservable by the casual observer, he calls covert or implicit behaviour. This latter, even though not seen, is behaviour reduced in magnitude to small muscular contractions.

Although the term "covert behaviour" is a rather recent one, the concept itself, has a long history. The earliest version was formulated by Isaac, the abbot of Stella in the 13th century, who defined it as imagination - an intelligence clothed in sensation. (Eysenck 1947). Carpenter, in 1853, gave it a name of "ideomotor action", by which it is still known.

More recent studies, in which the E.M.G. method was

COVERT BEHAVIOUR

Morgan (1948) discussing varieties of behaviour - whether they are evoked by external stimuli or whether they arise from a need within the organism; whether they are automatic or conscious and voluntary; and whether they are movements of the body as a whole or of a part of a limb in particular, differentiates two kinds of behaviour. One variety is observable and easily detectable, this he calls overt. The other which is unobservable by the casual observer, he calls covert or implicit behaviour. This latter, even though not seen, is behaviour reduced in magnitude to small muscular contractions.

Although the term "covert behaviour" is a rather recent one, the concept itself, has a long history. The earliest version was formulated by Isaac, the abbot of Stella in the 12th century, who defined it as imagination - as intelligence clothed in sensation. (Eysenck 1947). Carpenter, in 1852, gave it a name of "ideomotor action", by which it is still known.

More recent studies, in which the E.M.G. method was

used, have reopened the field of ideomotor interaction particularly with respect to thought and muscular tension.

Of particular importance in this field has been the work of Jacobson (1927), who found that contraction of specific muscles was not only concomitant with the occurrence of certain mental activities, but was essential to their occurrence, since imagination of a particular act failed to occur if the muscles involved in it were completely relaxed. He also found that when arm movements were magnified eighty-fold and photographed, imagined arm movements were always accompanied by actual movements of between 0.07 and 0.32 mm in extent. He further observed during his investigations using the electromyograph that large deflections, following the signal to imagine, were markedly increased in all cases, having a value from 340 to 530% of that during complete relaxation.

These studies leave little doubt that the thought or image of a movement is closely related to the muscles which carry out that movement. In other words the idea of a movement is frequently, if not always, followed or accompanied by an implicit movement employing the same

muscle groups as are involved in the imagined movement.

The Body Sway test provides confirmation that the image of a movement is the active factor which causes the actual movement. Berreman et al. (1938) tested 30 students under the following conditions:

- (a) Personal heterosuggestion;
- (b) verbal autosuggestion;
- (c) subvocal auto suggestion.

The differences in amount of sway caused by these three different methods were too small to be significant and the correlation between the three methods averaged +0.7. These findings were verified in a similar study by Eysenck et al. (1945), in which the intercorrelations averaged over +0.9 and no significant differences were observed in the total amount of body sway induced by these three methods.

It can be concluded that there is enough experimental evidence in support of the contention that an idea, or image, of a movement tends to produce the precise movement imagined or a modified form of it. The strength of this tendency varies from person to person. In some persons it is very strong producing

easily observable movements; in others it is very weak.

This phenomenon of covert behaviour is not unfamiliar in the psycho-pathological field. It is known here under the name "symbolic reactions" (Halliday, 1937) and "protective effort" (Wolff, 1947).

Pain and stiffness are assumed to be bodily expressions of such sentiments as for example "This gives me a pain in the neck" or "I must keep a stiff back in face of this". Other similar observable phenomena are described as for example "He trembled with fear, He shook with rage", etc.

Kubie (1953) described covert behaviour as "the language of the body". Under ordinary circumstances, emotional tensions which are generated through psychological experiences are expressed through the symbolic processes of speech and sensory imagery. These tensions can also be expressed through the "language of the body", that is, through some disturbance of sensation or somatomuscular or vegetative functions.

Covert behaviour then appears to be a common occurrence. It accompanies, in many instances, overt

(explicit) behaviour, but is most likely to be present in conditions in which "free expression" is hampered or a difficult task is to be performed.

DESIGN OF THE EXPERIMENT

This investigation was carried out on outpatients who were attending a General Hospital in the West Riding of Yorkshire. The hospital had a capacity of 301 beds and large outpatients' departments.

During the year 1953, 4,500 patients were admitted to the hospital. The casualty department received 14,687 new patients and in all 34,412 treatments were given. The outpatients' clinics had 13,204 new patients and there were 52,488 attendances. This hospital and a second General Hospital with a capacity of 420 beds supplied medical services to an area with a population of 130,000 people.

The area consisted of a central town of 90,000 inhabitants, three smaller towns of about 20,000 each and an extensive rural district. The towns had mixed industry - wool, cotton, steel, sugar, household chemicals, bricks, mixed engineering, and the rural district mixed farming.

This research, SECTION IV included patients of both

sexes from a wide range of social groups and mixed occupations.

DESIGN OF THE EXPERIMENT

The general procedure of the investigation was as follows.

This investigation was carried out on outpatients who were attending a General Hospital in the West Riding of Yorkshire. The hospital had a capacity of 301 beds and large outpatients' departments.

During the year 1953, 6,500 patients were admitted to the hospital. The casualty department received 14,687 new patients and in all 34,412 treatments were given. The outpatients' clinics had 13,204 new patients and there were 52,489 attendances. This hospital and a second General Hospital with a capacity of 420 beds supplied medical services to an area with a population of 150,000 people.

The area consisted of a central town of 98,000 inhabitants, three smaller towns of about 8,000 to 10,000 each and an extensive rural district. The towns had mixed industry:- wool, cotton, steel, sugar, household goods, bricks, mixed engineering, and the rural district mixed farming.

This research, therefore, included patients of both sexes from a wide range of social groups and mixed occupations.

The general procedure of the investigation consisted of:

1. Physical inquiry.
2. Psychological inquiry.
3. Physical treatment plus "desensitization".
4. The formation of a control group of matched patients who received physical treatment only.

Subjects for this research were drawn from the Physiotherapy Department of the above mentioned hospital. They were all outpatients diagnosed by consultant physicians or surgeons as suffering from muscular pain (e.g. fibrositis, muscular rheumatism, brachial neuralgia, lumbago, sciatica, myalgia etc.) and for whom some physical treatment was required. Pain, however, was not localized by the consultants in the strict sense of the word. The muscular structures were not given, only the region of the body was indicated, (e.g. low backache, fibrositis of neck, lumbago, pain in shoulder, etc.).

I. PHYSICAL INQUIRY

This inquiry covered two main points, namely pain and tension.

1. Pain.

Taken into account were the following:

- (a) General impression of subject's behaviour and subject's own story of complaint.
- (b) Subject's history. Data concerning age, sex, social and economic status, symptoms of the complaint and history of any previous illness were recorded.
- (c) Physical examination proper.
 - i) examination of subject's posture, wasting of muscles, contractions, limitations of movement, etc.
 - ii) localization of pain and definition of the involved muscular structures. This was done by means of palpation and manual muscle testing (technique of Daniels et al, 1952, modified in such a way that all muscle tests were carried out by testing the muscle against gravity or against some resistance, working the muscle concentrically in its outer range).

(d) Experimental removal of pain by means of passive relaxation and experimental re-induction of pain in the same structures by modified resisted movements. (A description of passive relaxation and resisted movements technique will be given at the end of this section).

(e) Experimental study of life situations and the occurrence of pain. A daily chart was prepared for each subject (see Appendix p.²⁰³.) and the daily fluctuation of pain incidence noted on a 3 point scale. As the subjects attended for treatment at least twice weekly, they were asked to recall the happenings of the days when there was any sudden fluctuation of pain in either direction (more severe or less severe). The subjects were also asked to express their attitudes and feelings towards these happenings. The life situations, attitudes, feelings and actions were noted opposite the pain graph.

2. Tension.

Assessment of the subject's degree of muscular tension was carried out by means of:

(a) Passive movements. With the subject lying supine, passive movements of arms and legs were carried out by the operator. If there was no tension present muscles did not offer any resistance nor did they assist

in performing any movement.

(b) Testing the ability of the subject to relax actively. The subject, lying supine, was asked to relax as much as he could, and was then tested by passive movements.

(c) Induction of relaxation passively.

(d) Subject's self rating. The subject was asked to say whether he regarded himself as being "tensed up". If so, would he say how much, how often and under what circumstances.

(e) Rating of subject's functional posture.

Observations were made on any form of abnormal motor behaviour displayed by the subject (e.g. clenching his fists, biting his fingernails, furrowing his forehead, holding his arm in a certain position, holding himself stiff, loss of lumbar curvature, etc.).

(f) Palpation of affected muscles.

(g) Tremor. The subject was asked to stretch out his hand with the palm face downward holding the three inner fingers together and the index finger abducted. He was then told to bring the index finger slowly towards the middle finger but not to touch it. If tension was present the index finger went into tremor.

This was aimed at THE PASSIVE RELAXATION TECHNIQUE. He was also asked to allow the operator to perform some gentle movements of his limbs, head, abdomen and chest, and not to make any resistance nor give any help.

- The two main features of this technique were:
1. The subject's full understanding of what was required from him; to start with the legs. One leg was raised.
 2. Complete passivity on the subject's part.

In order to give the subject a full understanding, he was first shown an object, such as a pencil, held in the fingers of the operator, and asked to observe what happened to it when it was released. The fingers released their grip and the object dropped by its own weight. If the subject already understood what was

required from him he would automatically allow his leg to drop and answer "Nobody". If however, the subject still had no full understanding, he would answer "Yes". In that event, the operator pointed out that nobody was holding his leg and that it should therefore drop in the same way as the released pencil. The subject was assured that these movements would be of small range and would not hurt. Throughout the procedure, the subject was instructed to breathe deeply with his abdomen (diaphragm). The foot, resting

on the couch, he was asked, "Who is holding your leg?" The answer usually was "Nobody". He was then asked to "make himself feel heavy and to feel sleepy" and let the knee drop thus rotating the thigh outwards with to imagine that he was sinking into a soft mattress. Some degree of abduction.

This was aimed at inducing a passive "attitude". He was also asked to allow the operator to perform some gentle movements of his limbs, head, abdomen and chest, and not to make any resistance nor give any help.

It was most convenient to start with the legs. One leg was held up by the ankle and the subject was asked, "Who is holding your leg?" The answer was "You". The operator then lowered the leg. Next the operator held up the subject's lower extremity by supporting the leg above the knee. (The subject usually kept the knee stiff). The operator repeated. "Who is holding your leg now?" If the subject already understood what was required from him he would automatically allow his leg to drop and answer. "Nobody". If, however, the subject still had no full understanding, he would answer "You". In that event, the operator pointed out that nobody was holding his leg and that it should therefore drop in the same way as the released pencil.

Next, with the subject's knee bent, the foot resting on the couch, he was asked, "Who is holding your leg now?" The answer usually was "Nobody". He was then asked to let the knee drop thus rotating his thigh outwards with some degree of abduction.

The knee was then brought back to the starting position several times and if the subject understood what was expected of him, he would allow the operator to bring it up and drop it sideways, without any help or resistance. The same was repeated with the other leg.

Afterwards, with both legs straight on the couch, the subject was told to allow the operator to roll his legs, which from the locomotor point of view is an inward and outward rotation of the thighs.

After relaxing the legs, the operator proceeded to relax the arms. The subject was still lying supine with his arms by his sides. The operator gently gripped one wrist and slightly elevated the subject's arm, expecting the subject to know what was required from him should the grip be released. Only exceptional cases would hold the arm in the elevated position after the operator had released the grip. They were then reminded that because nobody was holding the arm, it should drop on the couch by its own weight.

If the subject still experienced difficulty in relaxing his arm, the forearm was brought to the upright position and the subject was asked to drop the forearm

after the operator had released it. At the next stage, the operator gripped the subject's wrist, lifted the arm with the elbow slightly bent and asked the subject to let the operator perform the movement, which was to bring the arm, through abduction, to elevation and then to drop it on to the pillow beside the subject's head.

The same movements were carried out with the opposite arm and finally the subject, lying with his arms at his side supported on the couch, was instructed to allow the operator to perform further movements. These movements consisted of arm rolling, (inward and outward rotation of the arm). If the subject's arms and legs were relaxed, the rolling could be carried out passively without any difficulty.

Arm and leg rolling served as an indication of the degree of the subject's relaxation.

After the extremities, the operator proceeded to relax the neck muscles. The operator supported the subject's head by placing both hands behind the occiput, elevated the head slightly and at the same time instructed the subject that as soon as the operator released the support, he should allow his head to drop on to the

pillow by its own weight. This performance was repeated several times, the head being elevated each time somewhat higher from the pillow. Then the operator again gripped the head from behind and asked the subject to allow him to perform some further movements. Side flexion of the neck and head rotation were carried out. The subject was again told neither to resist, nor to help. Full passivity was required. Neck relaxation was completed by head rolling. The subject's head, while lying on a pillow, was rolled from side to side. This was performed by the operator placing his hand on to the subject's forehead.

The next step was to relax the chest and abdomen. The subject lying supine in the same position, was asked to breathe in deeply with his abdomen. The operator placed his hand on the middle of the abdomen and asked the subject to breathe out. At the same time the operator pressed his hand down on the abdomen. Then the subject was again asked to breathe in; this time the operator exerted some pressure on the abdomen which caused the subject to breathe in, against some resistance. This was repeated two to three times; each time the operator increased the pressure, until during expiration,

the pulse of the abdominal aorta could be felt. The feeling of this pulsation was a sign that the muscles of the abdomen were relaxed.

The operator's hands were then placed on both sides of the chest wall and the subject was asked "to push the hands out" by breathing in. This was repeated several times and the pressure of the operator's hands was increased with each inspiration. This encouraged the subject to breathe deeply and when finally the pressure was released, a deep expiration manifested itself by a "sigh out". This, in turn, was taken as a sign that the subject's chest wall was relaxed.

In case the general relaxation did not remove the existing pain, the operator concentrated on the pain-involved muscle, or muscle group, carrying out every passive movement possible in the muscular structures and joints involved. The subject was reminded again not to help or to resist the movements performed by the operator.

After a few sessions of passive relaxation, the subject knew what was required from him and was able to

relax himself without the help of the operator. The verbal instruction given by the subject himself "to feel heavy, to feel sleepy, to make his limbs feel lifeless" and "to breathe deeply with his abdomen" was sufficient to obtain full relaxation.

THE MODIFIED RESISTED MOVEMENTS TECHNIQUE

After the subject was passively relaxed, modified resisted movements were carried out. The object of these movements was to reinduce pain in the affected muscles.

The subject was instructed to resist the passive movements carried out by the operator, e.g. if the Deltoid was involved, the subject was reminded that he was not to allow the operator to adduct his arm passively but to exert some resistance.

Pain could also be re-induced by means of sharp taps on a muscle with the finger tips, e.g. in a case in which the hamstrings were involved, after removal of pain by passive relaxation, a few taps given by the operator with the finger tips on the belly of the hamstrings would produce contraction of this muscle group and the subject

INTERVIEW (interim) - Bureau PSYCHOLOGICAL TESTS

would again feel pain.

These resisted movements and the sharp taps on the belly of a muscle were capable of re-inducing pain in any pathologically painful muscular structure without exception.

It has to be stressed that in a healthy muscle, neither these resisted movements, nor the taps on a muscle were ever capable of producing muscular pain experimentally.

II. PSYCHOLOGICAL INQUIRY.

The psychological inquiry consisted of two independent investigations; one by means of a standardised interview, the other by psychological tests. The results of these investigations were afterwards compared and if there was a large discrepancy between these two findings, further investigation by means of interview was carried out.

The interview technique and the psychological tests employed were as follows:

INTERVIEW (standardised) versus PSYCHOLOGICAL TESTS

1. Personality assessment. Self assessment

On the basis of a prepared scheme of behaviour tendencies as listed by Murray (1949), the outstanding feelings, attitudes and general motor and verbal behavioural patterns displayed by the subject were assessed. (See Appendix p.204-223).

The subject was asked to identify his feelings, attitudes and actions presented to him on a questionnaire which contained three behaviour variables. These behaviour variables were chosen on the basis of the assessment by interview, and were assumed to represent the most probable pertinent behaviour

tendencies of the subject tested. If no variable seemed appropriate to the subject, he was asked to describe briefly his feelings and actions at the time, or just before, he became ill.

(See Appendix p.224-226).



2. Assessment of subject's disruption of behaviour. versus The Hysterical Scale (Hy) of the Minnesota Multiphasic Personality Inventory (M.M.P.I.).

This was done primarily by taking into account the signs and symptoms of the autonomic nervous system activities displayed by the subject.

(See Appendix p.227...).

3. Assessment of subject's bodily preoccupation. versus The Hypochondriasis Scale (Hs) of M.M.P.I.

This was carried out with the help of a prepared list of points dealing with bodily preoccupation.

(See Appendix p.231...).

4. Assessment of subject's recent environmental stress. versus The Word Association Test. (See Appendix p.233...).

This was carried out in connection with history taking: what happened to the subject just before or about the time he got his pains. The subject was encouraged (but never pressed too strongly), to talk on any of his distressing psychological experiences. Further to this, the subject was encouraged to talk about himself as a person rather than as a medical case.

Since the standardised interview served as the main technique in this investigation, some details about it need to be given.

It is obvious that the skilful interviewer will develop particular techniques which work for him, though they may not serve another investigator (Kinsey et al, 1949). Nevertheless, the main points to which special attention was given included:

1. The subject was assured of privacy.
2. The subject was put at ease and treated with courtesy as a friend. There was no blaming or criticising. During the interview maximum attention was given to the subject and minimum attention to the record.
3. In order to build up confidence and understanding the interview began with more general items so as not to disturb the subject, followed by a sequence of items, which gradually led into the subject's difficulties.
4. In the literature on interviewing, it is customary to advise that records should not be made in the presence of a subject, but that they should be made immediately after the subject has left. This is the commonest procedure among many psychiatrists, clinical

psychologists and many social workers. It is supposed that a subject is embarrassed at seeing statements put on paper, and that he will talk more freely if he feels that he can say some things that are not recorded. This procedure was adopted fully. There is, on the other hand, the criticism that recording after the subject has left may involve omissions, or even produce distortions in the record. However, in this experiment there was the opportunity to check the records as the subjects returned for several treatments and each treatment session was an interview session as well.

5. For each history in the present study there has been a systematic coverage of a basic minimum of about fifty items. While there was a basic minimum of material that was covered on each history, there was no hesitancy, on the part of the interviewer, to attempt to secure additional data on special situations if such were presented by the subjects.

6. When dealing with a socially involved question such as environmental adjustment or life difficulties, it became particularly important to ask direct questions without hesitation.

of patients who had III. TREATMENT were mentioned.

Within this framework the subjects were able to make their

own. The experimental group, in addition to normal physical treatment, received further treatment in the form of "desensitization". This was carried out simultaneously with physiotherapy by means of:

(1) Disruption of established motor behavioural patterns by induction of relaxation - first passively, then actively by the subject himself.

(2) Reassurance - (supportive therapy).

(3) Insight - (self-directive therapy). Both forms of treatment in this group were carried out by the investigator.

During history taking, physical examination, psychological investigation and the administering of physical treatment, great care was taken to produce a permissive atmosphere which would encourage the subject to express himself as freely as possible. At the same time no opinions were offered nor were any judgements made.

Some subjects in the study had difficulty in describing their stress situations. In order to assist them to verbalize their problems the non-directive approach (Rodgers, 1942) was used. The life difficulties

suffering from muscular pain.

of patients who had similar symptoms were mentioned. Within this framework the subjects were able to make their own decisions about their personal experiences and gain a closer insight into self-understanding.

Applying the principle of active participation in treatment, the subjects were gradually led to understand that they themselves were responsible for their improvement.

IV. CONTROL GROUP.

The experimental group was matched with subjects closely similar as far as the complaint, site of pain, history of the disorder, frequency of attendances for treatment and means of treatment were concerned. Age, sex, occupation and social conditions were further criteria for selecting the control group.

The control group received physical treatment only, administered by other physiotherapists in the department (who had the same professional qualifications and similar length of service as the investigator).

In both groups, the assessment of the degree of recovery was made by the same consultant physicians and surgeons who, in the first place, diagnosed the subjects as suffering from muscular pain.

SECTION V

DESCRIPTION OF THE MEASUREMENT TECHNIQUES

To obtain quantitative measurements in clinical psychology presents great difficulty. This difficulty is still further increased if an investigation is centred on the individual as a "whole" and if his behaviour is examined within his continuous interaction with his environment. In this study, therefore, most of the quantitative measurements had to rely on ratings.

MEASUREMENT OF PAIN.

Pain is so wholly subjective that an accurate estimate of its severity (intensity) is always difficult. Some investigators go even so far as to say that there is no objective measurement of pain. (Ogilvie, 1950).

Anatomically, pain is considered in two categories: superficial and deep pain. As superficial pain is more suitable for experimental investigation, a quantitative scale for this category has been elaborated. The measurement of intensity is the "dol"; one dol is the equivalent of the sum of 2 jnds (Just noticeable differences). (Hardy et al, 1952).

For deep pain such measurements cannot be applied. Therefore it was necessary to adopt an arbitrary intensity scale, consisting of a rating, according to which 0 = no pain, 1 = some pain and 2 = severe pain. Intermediate steps were 1+ and -1; 1+ indicating a great deal of pain, and -1 little pain. The estimation of intensity of pain was based on the subjects' description of the pain and their reactions to it and its interference with their well-being and their work.

The question of quality of pain lent itself to more precise estimation. Data collected were under the following headings:

- (a) quality - pricking, burning, aching;
- (b) extension - localization and area of diffusion;
- (c) temporal aspects - duration, time of occurrence, mode, etc. In addition, the factors of onset and fluctuation of pain were assessed, eg. what brings on the pain or what seems to increase or lessen the pain.

MEASUREMENT OF TENSION.

There are many indices of tension. Davies (1942) classified the many kinds of techniques used to measure

tension into six major groups.

By far the most widely used technique in experimental situations, is the recording of action potentials from muscles. These may be regarded as direct indications of the tension of muscles in one sense of that word. The indication given is one of muscular activity, and with suitable disposition of apparatus the activity of simple muscles, or parts of muscles, can be recorded. Theoretically this seems very sound; practical application of this technique, however, involves several difficulties impossible to overcome at present, especially in a clinical setting.

In order to test a simple muscle, or part of it, needle electrodes insulated at different depths must be used. The introduction of a needle is of course likely to disturb the ordinary patient and invalidate the record. (Davies, 1942). There is also another technical difficulty in using this procedure, namely the lack of objective measurement of the insertion of the needle into the right muscle. This difficulty is especially prominent when deeper structures are involved e.g. the Sterno-costalis or the Psoas muscle.

There is, in addition, the surface electrode technique. It is impossible, using this technique to obtain any measurement of a single deep lying muscle, and after all, since differential relaxation of various muscular groups in the human organism is an accepted fact, and since no one muscular group has yet been discovered to reflect adequately the level of tension in the majority of other muscles, it follows that no one placement of electrodes makes possible a reliable index, even of general muscular tension (Wenger, 1943).

Since no single fully objective test to measure muscular tension was available, a rating scale had to be employed. The subjects were rated on physiological and behavioural variables displayed by them and self-rating served as an additional measurement. The rating scale employed was: 0 = no tension; 1 = some tension; 2 = very tense; with 1+ (= 1.5) and -1 (= 0.5) as intermediate steps. The obtained results were averaged and this score served as an index of the subjects' muscular tension.

MEASUREMENT OF PERSONALITY FACTORS.

Since the investigation was aimed at finding out why

an individual behaves as he does, a testing procedure had to be adopted, which would provide some information about the subjects' inner needs or drives as stimuli for action. It is generally accepted in personality theory that each function or form of behaviour serves an organismic purpose. In other words behaviour is goal-directed. (Levin, 1935 and Klein et al, 1951), the goal being some specific relation of the organism to its internal and/or external environment. Since few of these goals are actually realised, they have to be discovered and defined indirectly by pertinent behavioural manifestations which represent an organismic "need" or "drive" to achieve a particular goal. Murray's whole analysis of personality depends on this assumption. The work of H.A. Murray and his collaborators at Harvard Psychological Clinic was therefore used as the basis for a behaviour tendency rating scale.

Murray (1949) has given elaborate descriptions of some 30 needs or variables of personality. For the purpose of this research 16 of his manifest dispositional tendencies (needs) were adopted in which motor and verbal action was closely correlated with subjective reports of intention (such as wish, desire, impulsion, aim, purpose,

expectation) general feelings and attitudes of the individual.

The assessment of behavioural tendencies of an individual was carried out by:

(1) Rating on a 3 point scale:

0 = absence of behaviour tendency;

1 = presence in slight degree;

2 = presence in marked degree;

with intermediate stages -1 and 1+.

(2) Ranking:

Three of the most outstanding behaviour tendencies of a subject were ranked in order 1 to 3.

(3) Subject's self-rating:

Each subject was presented with an individually prepared questionnaire based on previous rating and ranking and he was asked to identify the feelings, actions and attitudes he experienced at the time of onset of his muscular pain. If none of these descriptions fitted into the feelings, attitudes and urge of actions or expectations he had experienced during that particular period, he was asked to state briefly how he felt and what he would most likely have done if he had

been allowed to express himself freely.

From these three assessments the pertinent behavioural pattern of the individual was finally established, and compared with the site of pain, (the muscular structures involved) and the environmental stress situation.

MEASUREMENT OF SUBJECT'S DISRUPTION OF BEHAVIOUR.

Emotions are usually regarded as conditions of psychological causes, which have a disorganising effect on the activity the organism may be engaged in at the time. Behaviour is disturbed and effective adjustment is said to be more or less impeded. The condition includes changes in observable behaviour, certain visceral phenomena, and a definite affective experience.

Emotion, however, is a difficult topic about which there is little agreement at the present day. It includes a great variety of patterns of behaviour and of feeling. Consequently, it has been hard to arrive at a good classification of emotions. Really conclusive and quantitative experiments have been few and far between and there has been a great deal of argument and confusion about theories of emotion. (Morgan et al, 1950). For

the purpose of this research emotion is taken as a hypothetical concept that stands for an excitatory process that may manifest itself subjectively, objectively or both. Emotion is usually felt, the subjective manifestation being that quality of an experience which is generally designated by the word "emotional" (excited) - a variable very difficult to measure. The objective manifestation is a compound of autonomic disturbances, affective actions and the intensification or disorganisation of effective behaviour, motor or verbal. The latter was chosen as the basis for the assessment of the subject's disruption of behaviour.

A list of signs and symptoms of autonomic disturbances and of general "emotional" behavioural symptoms was drawn up and the severity of disruption of behaviour of the subject assessed by taking into account the number of displayed symptoms, their severity and repetitions and their interference with normal life.

A three point rating scale was adopted:

0 = no disruption of behaviour; 1 = some disruption of behaviour and 2 = marked disruption of behaviour. Intermediate stages were rated -1 and 1+.

Findings obtained in this way were supplemented by the Hy (hysterical) scale of the M.M.P.I. The scale measures the degree to which the subject is similar to individuals who have developed "hysteria". Such symptoms are usually the result of a stress situation and without any real physical pathology. They also signify a more immature psychological make-up of the individual (Hathaway et al, 1951).

The obtained T scores of the Hy scale were translated into the adopted arbitrary scale and compared with the data obtained on rating. If there was too great a discrepancy between these two measurements, the subjects were re-examined.

TABLE I

TRANSLATION OF T SCORES OF THE HY SCALE
INTO THE ADOPTED RATING SCALE.

T scores		Rating Scale.
46 - 54	=	0
55 - 59	=	-1
60 - 64	=	1
65 - 69	=	1+
70 +	=	2

MEASUREMENT OF SUBJECT'S BODILY PREOCCUPATION.

A list of questions indicating bodily preoccupation was drawn up and the subjects were rated according to the number and the severity of symptoms displayed.

A three point rating scale was employed:
0 = no bodily preoccupation, 1 = some bodily preoccupation and 2 = marked interest in bodily functions. Intermediate stages were -1 and 1+.

This rating was supplemented by the M.M.P.I. Hs scale which represents a measurement of the amount of abnormal concern about bodily functions. Persons with high Hs scores are unduly worried over their health. (Hathaway et al, 1951). The T scores of the Hs scale were translated into the arbitrary rating scale and these values were compared with the data obtained on rating, (a similar procedure to that employed in the assessment of the subject's disruption of behaviour).

MEASUREMENT OF SUBJECT'S MALINGERING.

The same list of questions plus the M.M.P.I. Hs scale as for assessing bodily preoccupation was used. With a few additional questions concerning the subject's

desire for "gain" or "exemption".

The subjects were assessed on a three point scale: 0 = no malingering, 1 = some malingering, 2 = marked malingering with -1 and 1+ as intermediate stages.

MEASUREMENT OF SUBJECT'S RECENT ENVIRONMENTAL STRESS.

The meaning of environmental stress is so very subjective that it is doubtful whether it will ever be possible to assess it quantitatively. Therefore it was only possible to determine whether there was any environmental stress and to ascertain the subjects' reaction to that stress. The environment in this assessment was conceived not as a physical reality alone, but, in effect, a projection of the individual's own concepts and interpretations upon his surroundings.

In order to obtain an objective check of subjects' recent environmental stress, assessed during the interview, the Word Association Technique was used. (Cattell, 1948). A list of fifty three words was drawn up. It included: three practice words; thirty two words indicating two behavioural tendencies of each of the sixteen manifest

behaviour variables used for personality assessment (e.g. for aggression the inserted behavioural tendencies were: kick, anger); ten buffer words and eight words which were designed to indicate the subject's recent environmental stress, assessed during the interview. Eight blanks were left in the general list, into which appropriate words for each subject were written, depending on the outcome of the interview.

If the results of this test confirmed the environmental stress defined during the interview, then results, so defined, were taken for granted. If, however, a discrepancy between these two techniques occurred, significant words from the Word Association Test were selected, (usually about eight to twelve) and used as a basis for further inquiry in order to unravel the reasons for particular responses and in this way establish the most probable motives for covert actions.

In addition to the information about the environmental stress, this test also offered some evidence as to personality make-up. This was utilised as a further check in defining the subject's outstanding behavioural tendencies.

MEASUREMENT OF SUBJECT'S RECOVERY.

This assessment was carried out by the consultant physicians and surgeons who diagnosed the subjects in the first place as suffering from muscular pain. The rating was based on the consultant's description of recovery, entered in the subject's case sheet.

The rating was as follows:

I.S.Q. or no better	=	0
Slightly improved	=	-1
Improved	=	1
Much improved	=	1+
Free from pain or cured	=	2

Assessment of subjects' recovery in the control group was carried out in a similar way.

SECTION VI

STATEMENT OF RESULTS

This investigation included, originally, 120 subjects. Of this number 5 subjects "ceased to attend" and 3 subjects were discharged as "cured", before the full investigation could be completed. Therefore the actual number of the sample in this investigation was 112 - 51 male and 61 female subjects.

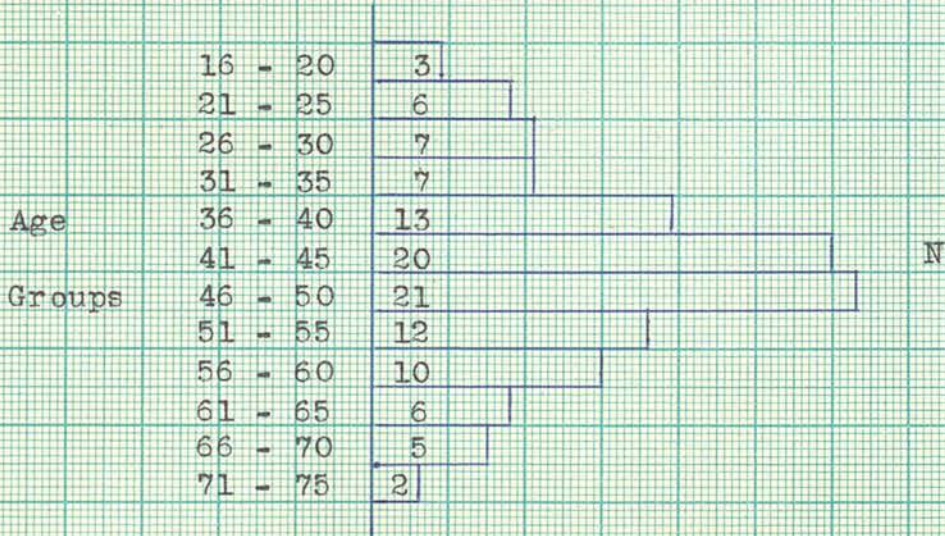
TABLE II

DISTRIBUTION BY AGE OF SUBJECTS IN THE SAMPLE.

<u>Age</u>	<u>Number of subjects</u>
16 - 20	3
21 - 25	6
26 - 30	7
31 - 35	7
36 - 40	13
41 - 45	20
46 - 50	21
51 - 55	12
56 - 60	10
61 - 65	6
66 - 70	5
71 - 75	2
Totals	112

Figure 1

Distribution by Age of Subjects in the Sample, N=112



Localization of Pain.

According to the consultants' diagnoses in which the region of the site of pain was indicated, the subjects were divided into 8 groups as shown in Table III.

TABLE III
ANATOMICAL REGIONS AND NUMBER OF
SUBJECTS IN PAIN INVOLVEMENT

Anatomical region	Number of subjects		
	Male	Female	Totals
Occiput and neck	4	7	11
Shoulder	12	16	28
Arm and forearm	5	4	9
Chest wall and scapular region	4	6	10
Back	13	15	28
Front of thigh and leg	6	5	11
Gluteal region and back of thigh and leg	6	5	11
Coccygeal region	1	3	4
Totals	51	61	112

Subjective findings.

From the subjects' point of view the muscular pain experienced was diffuse and, as a rule, poorly localized.

Examination revealed that the pain could be localized in exact anatomical structures, which when considered in relation to the action they performed, showed well defined functional units. Closer examination of the affected

muscular structures involved revealed that they could be split into 2 groups: one comprising the main muscular structures in which pain was most severe and the other, additional muscular structures, in which pain was less severe. This second group comprised muscles often far away from the initial site of the complaint. The latter group indicated the extent of diffusion of pain.

The following outline indicates for each affected regional group the main and additional muscular structures involved at the moment of examination. The additional muscles enumerated indicate the spread of pain (so called referred pain). The main muscles affected are those written in capital letters below:

1. Occiput and neck. N = 11.

(a) RECTUS CAPITIS
MAJOR ET MINOR N = 7.

Additional
muscles: Occipitalis
Deltoid
Supraspinatus
Extensors of wrist
Pectoralis major
Rhomboids

(b) LEVATOR SCAPULAE N = 3.

Additional
muscles: Nil

3. Arm and Forearm.

In one subject in this group, it was not possible to localize the pain. This particular subject was diagnosed as: "Pain in neck and both shoulders, probably fibrositis". She was, after three weeks of treatment, redirected to the Ear, Nose and Throat Department.

(b) COMMON FLEXORS OF WRIST

2. S h o u l d e r. N = 28.

(a) SUPRASPINATUS AND DELTOID N = 25.

Additional muscles: Rectus capitis major et minor. Levator scapulae Extensors of wrist Brachialis Pronator teres Pectoralis major

4. Chest Wall and Scapular Region

(b) PECTORALIS MAJOR N = 3.

Additional muscles: Deltoid Supraspinatus Serratus anterior Rectus capitis major et minor

(b) DIAPHRAGM AND STERNO-COSTALIS

3. Arm and Forearm. N = 9.

(a) COMMON EXTENSORS
OF WRIST

N = 5.

Additional
muscles:

Brachialis
Pronator teres

(b) COMMON FLEXORS
OF WRIST

N = 3.

Additional
muscles:

Common extensors
of wrist
Pronator teres

(c) BRACHIALIS

N = 1.

Additional
muscle:

Deltoid
Serratus anterior

4. Chest Wall and
Scapular Region N = 10.

(a) SERRATUS ANTERIOR N = 5.

Additional
muscles:

Supraspinatus
Deltoid
Quadratus lumborum
Iliocostalis

(b) DIAPHRAGM AND
STERNO-COSTALIS

N = 5.

Additional
muscles:

Supraspinatus
Quadratus lumborum
Iliocostalis

5. Back. N = 28.

(a) QUADRATUS LUMBORUM
et TENSOR FASCIAE
LATAE

N = 22.

Additional
Muscles:

Iliocostalis
External rotators
of hip
Psoas, Iliacus
Rectus abdominis
Hamstrings
Soleus
Serratus anterior

(b) PSOAS et ILLIACUS

N = 6.

Additional
Muscles:

Quadriceps
Serratus anterior

6. Front of Thigh and
Leg.

N = 11.

(a) VASTUS INTERMEDIALIS N = 4.

The scatter in this region was large and the sample small; it was therefore, impossible to indicate clearly any real group. Hence the rest were classified as "additional".

Additional
muscles:

Extensor digitorum
longus
Soleus
Tensor fasciæ latae
Psoas, Iliacus
Pectineus
Adductor brevis
Peroneus longus et
brevis

7. Gluteal Region and Back of Thigh and Leg. N = 11.

SEMIMEMBRANOSUS)
SEMITENDINOSUS) HAMSTRINGS
BICEPS FEMORIS)
SOLEUS N = 11.

NUMBER OF SUBJECTS		Additional muscles:
Degree of pain		Quadratus lumborum
No. of subjects		Tensor fasciae latae
		External rotators of thigh
		Gluteus maximus (coccygeal part)
		Tibialis posterior

8. Coccygeal Region. N = 4.

GLUTEUS MAXIMUS)
LEVATOR ANI) Coccygeal part
N = 4.

Additional muscles: Quadratus lumborum
Tensor fasciae latae

As can be seen, the deep layers were usually the site of pain. Functionally these muscles were the so-called prime movers.

Quantity of pain.

Quantity of pain was assessed by rating on a 5 point scale. The results are shown in Table IV.

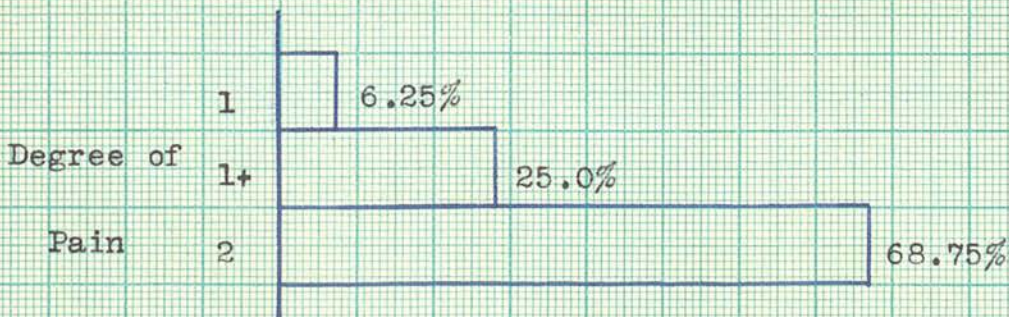
TABLE IV

NUMBER OF SUBJECTS AND DEGREE OF PAIN.

Degree of pain	0	-1	1	1+	2	Totals
No. of subjects	-	-	7	28	77	112

Figure 2

Degree of Pain in the Sample, N=112



Quality of Pain.

In all subjects, without exception, the pain was 'aching', although the length of time of the pain experience varied from "stabs" of short duration to prolonged periods of dull ache.

Tender spots.

To avoid any confusion it must be stressed that the name "tender spots" makes reference to findings different from Stockman's (1920) concept of "fibrositic nodules". Stockman's concept has not been substantiated in any way (Cyriax, 1947).

The present findings tended to confirm the theory of "trigger areas" put forward by Elliot (1944). The affected muscles showed without exception, tenderness along their entire length. In acute cases this sometimes went as far as hardening as it appears in muscular cramp. In chronic cases this sometimes showed itself in fine crepitus, stringiness and shortening of a muscle. Palpation along the course of a muscle revealed that pressure on some parts of a muscle produced more pain than the same pressure exerted on other parts. These tender parts (spots) limited themselves, as a rule, to

the junction between the muscular and tendinous part of a muscle. In long muscles, e.g. hamstrings, such tender spots corresponded clearly to the far ends of the fleshy parts of the muscles. Shorter muscles with wide fleshy origin, e.g. supraspinatus, showed a somewhat increased and wider spread of tenderness at their origin; or in Serratus anterior such tender spots were found along the medial border of the scapula and along its insertion in several ribs. In no muscle was there ever found a tender spot in the belly of the muscle itself.

TABLE V
DEGREE OF PAIN AND SEVERITY OF

The subjects themselves were absolutely unaware of these tender spots.

Pressure on a tender spot elicited a severe and agonising pain, which was similar in quality and extent to the spontaneous pain of which the subject complained. Pain, elicited in this way, was appreciably increased when the muscle in question was forced into isometric contraction in the outer range. The presence of these tender spots can be regarded as an objective sign of muscular pain and also as an indicator of pain severity.

These tender spots were found to be consistent in

all cases in the sample, e.g. when pain was experienced in the Deltoid, three tender spots could be detected: one near the origin of the anterior fibres, one near the origin of the posterior fibres and one near the insertion. With progress in improvement these tender spots tended to disappear.

Tables V and VI show the severity of tender spots before treatment and upon completion of treatment.

TABLE V
DEGREE OF PAIN AND SEVERITY OF
"TENDER SPOTS" BEFORE TREATMENT
N = 111

		Degree of Pain				
		2	1+	1	Totals	
Severity of "Tender spots"	++	77	11	-	88	++=very severe
	+	-	16	7	23	+= severe
	1	-	-	-		1 = traces
	0	-	-	-		0 = none
Totals		77	27	7	111	

N.B. In one subject muscular pain could not be localized, therefore not included in these figures.

TABLE VI

DEGREE OF PAIN AND SEVERITY OF "TENDER SPOTS"
UPON COMPLETION OF TREATMENT

N = 111

		Degree of Pain						
		3	2	1	-1	0	Totals	
Severity	++	7	2				9	++=very severe
of	+		2	11	7		20	+ = severe
"tender	1			5	13	15	32	1 = traces
spots"	0					50	50	0 = none
Totals		7	4	14	20	65	111	

TABLE VI
DEGREE OF PAIN AND SEVERITY OF "TENDER SPOTS"
UPON COMPLETION OF TREATMENT

N = 111

		Degree of Pain							
		2	1+	1	-1	0	Totals		
Severity of "tender spots" Totals	++	7	2				9	++=very severe	
	+		2	11	7		20	+= severe	
	1			3	13	16	32	1= traces	
	0					50	50	0= none	
			7	4	14	20	66	111	

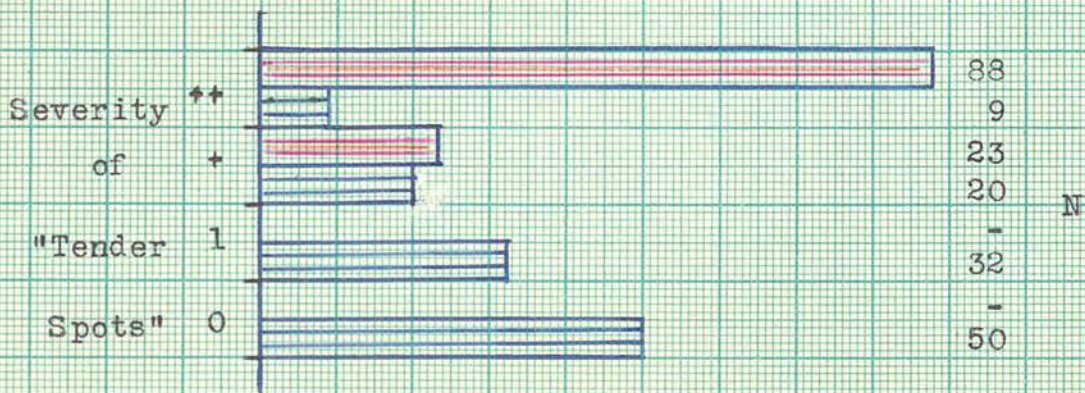
Other physical findings.

Data have also been obtained with respect to the muscular system, including the nature of weakness, muscle wasting, atrophy, relaxation and other associated symptoms. The following data have a direct bearing on the question of the degree of clinical involvement in the various muscles of the body. The data are given in the following table.

Figure 3

Severity of "Tender Spots" Before and After Treatment, N=111

Before Treatment After Treatment



showed a definite relationship with changes in abnormal

Other physical findings.

Data have also been obtained with regard to fine muscular crepitus, stringiness, limitation of movement, muscle wasting, shortening, deformities and other associated symptoms. Because these findings do not have a direct bearing on the hypothesis, (they rather have clinical implications), it is not proposed to elaborate them here. All these symptoms were the result

of muscular contractions of long duration (chronic muscle pain).

NUMBER OF SUBJECTS AND CONDITIONS INVOLVED IN SPREAD OF PAIN

Spread of Pain.

There was a considerable amount of spreading, so called "shifting" of pain, from one muscle group to another. Pain, for instance, may have started at first in the lumbar region and then have become persistent in the back of the thigh and leg; or have started in the region of the elbow and then "travelled" up the arm into the shoulder region and finally to the neck. Of the sample, 28 subjects reported such "shifts" before treatment began and in 9 subjects such displacement occurred during the course of actual treatment. Such "shifts" showed a definite relationship with changes in external or internal environmental situations and the subject's reaction towards them. Table VII indicates the spread of pain.

Nevertheless, these 9 subjects reported some interesting conditions which have been reported in the literature under the heading: "Pain usually worse" or "Pain usually better". Some subjects showed marked relief of pain during their course of treatment, others did not.

These sudden and TABLE VII situations were studied
in the light of NUMBER OF SUBJECTS AND CONDITIONS Factors
Involved and INVOLVED IN SPREAD OF PAIN involving such

Time of Occurrence	Spread of pain due to changes in:		Totals
	external environment	internal environment	
Before treatment	23	5	28
During treatment	7	2	9
Totals	30	7	37

Fluctuation of pain in the same muscular structures.

During the course of treatment of each subject, which lasted from 2 to 90 days (Mean = 25 days), in 105 cases (93.7% of the total sample), a sudden increase or decrease in pain severity was observed. Only 7 cases (6.3% of the sample), did not show such fluctuation. Nevertheless, these 7 cases showed some minor fluctuations which have been included in the record under the heading: "Pain usually worse" or "Pain usually eased". Some subjects showed several sudden fluctuations during their course of treatment, others only one or two.

TABLE VIII

FLUCTUATIONS OF PAIN AND LIFE SITUATIONS

These sudden and gradual fluctuations were studied in the light of each subject's life situation. Factors involved and the number of subjects experiencing such changes are shown in Tables VIII and IX.

No. of Incidents	Physical exertion	Other physical factors	Environmental stress situations	Distressing feelings, anticipations and negative activities
52	8	47	100	100

Pain usually worse:

1. Towards the end of a strenuous working day observed in 42 subjects.
Pertinent symptoms present:
 (a) Fatigue; $N = 39; p = 0.86$
 (b) Headaches; $N = 53; p = 0.76$
2. During the night observed in 101 subjects.
Pertinent symptoms present:
 (a) Sleep disturbances; $N = 91; p = 0.96$
 (b) Headaches; $N = 50; p = 0.89$
3. During the week-end and holidays observed in 49 subjects.
Pertinent symptoms present:
 (a) Depression and boredom; $N = 29; p = 0.71$
 (b) Headaches; $N = 41; p = 0.83$
4. Due to other factors operative which could not be accounted for observed in 5 subjects.

Note: $p =$ probability as proposed by the tables

Total number of incidences of each
total number of pertinent symptoms

(Harvard, 1951)

TABLE VIII

FLUCTUATIONS OF PAIN AND LIFE SITUATIONS

Increase of Pain

Sudden increase of pain due to:

No. of Incidents	Physical exertion	Other physical factors	Environmental stress situations	Distressing feelings, anticipations and negative attitudes	Totals
	52	8	47	103	210

Pain usually worse:

1. Towards the end of a strenuous working day observed in 42 subjects.
 Pertinent symptoms present:
 - (a) Fatigue; N = 37; p = 0.88
 - (b) Headaches; N = 33; p = 0.78
2. During the night..... observed in 101 subjects.
 Pertinent symptoms present:
 - (a) Sleep disturbances; N = 91; p = 0.90
 - (b) Headaches; N = 60; p = 0.59
3. During the week-end and holidays.....observed in 49 subjects.
 Pertinent symptoms present:
 - (a) Depression and boredom; N = 35, p = 0.71
 - (b) Headaches; N = 41, p = 0.83
4. Due to other factors operating which could not be accounted for observed in 5 subjects.

Note: p = probability as computed by the ratio:

$$\frac{\text{Total number of occurrences of event}}{\text{Total number of pertinent symptoms}}$$

(Moroney, 1951).

TABLE IX

FLUCTUATIONS OF PAIN AND LIFE SITUATIONS

DECREASE OF PAIN

Sudden decrease of pain due to:

No. of incidents	Physi- cal rest	Other Physi- cal factors	Change in Environ- ment	Joyful feelings achieve- ments, positive attitudes	Totals
46	5	44	97	192	

Pain usually eased:

1. When keeping off strenuous work
observed in 38 subjects.
2. After having moved about
observed in 101 subjects.
3. While being occupied
observed in 37 subjects.
4. When other factors operated which could not be
accounted for
observed in 2 subjects.

There is a discrepancy between figures given in "pain usually worse" and "pain usually eased". Of the subjects who became worse towards the end of a strenuous working day, four did not feel relief when keeping off strenuous work. These were subjects who described themselves as "worriers". Then there were 49 subjects who usually felt worse during week-ends and holidays but only 37 of them felt better when occupied. The other 12 were those subjects who showed far advanced signs of fatigue; they were unable to be normally occupied. These latter were classified as "chronic". As a rule there were more subjects who experienced either sudden or gradual increase of pain than subjects with sudden or gradual decrease of pain.

Factors which seemed to have influenced the existent muscular pain in one or other direction were cold, damp and draughts and, at the other extreme, mild heat. All subjects, without exception, reported increase of pain when feeling cold. This feeling was often augmented by a damp atmosphere and draughts. All patients reported relief when feeling gentle warmth, (mild heat). There were, however, 4 subjects who reported an increase in pain when feeling too hot during the night in bed.

TABLE X

DEGREE OF PAIN AND TENSION BEFORE TREATMENT

Pain and Muscular Tension.

The degree of pain and muscular tension was assessed twice - once at the beginning of treatment and once at the end. Table X shows the relationship between pain and tension before treatment.

	Degree of Tension			Totals
	-1 or 1	1+	2	
-1 or 1	8	1		9
1+	2	30	4	36
2	1	11	45	57
Totals	11	42	49	102

The coefficient of contingency was calculated from a 3 x 3 table (as shown below) by Garret's (1932) method B.

		Degree of Tension			Totals
		-1 or 1	1+	2	
Degree of Pain	-1 or 1	8	1		9
	1+	2	30	4	36
	2	1	11	45	57
	Totals	11	42	49	102

$$C = \sqrt{\frac{F-1}{F}}$$

$$C = 0.69$$

Garrett's coefficient

$$C = 0.618$$

TABLE X

DEGREE OF PAIN AND TENSION BEFORE TREATMENT

		<u>Degree of Tension</u>				Totals
		-1	1	1+	2	
Degree of Pain	-1					
	1	1	5	1		7
	1+	1	1	20	6	28
	2		1	11	65	77
Totals		2	7	32	71	112

The coefficient of Contingency was calculated from a 3 x 3 table (as shown below) by Garrett's (1947) method B,

		<u>Degree of Tension</u>			Totals
		-1 or 1	1+	2	
Degree of Pain	-1 or 1	6	1		7
	1+	2	20	6	28
	2	1	11	65	77
	Totals	9	32	71	112

$$C = \sqrt{\frac{P-1}{F}}$$

$$C = 0.69$$

$$C_c = \frac{1}{\sqrt{N}}$$

$$= 0.094$$

Garrett's correction:

$$C = \frac{C}{0.816} = 0.820$$

$$C.R. = \frac{C}{C_c}$$

$$= 8.7$$

Whenever, during the course of treatment, there was fluctuation in pain severity, tension varied accordingly - increased with increase of pain and decreased with decrease of pain. This was observed in 102 cases out of 105. (97.1%).

The accompanying figures (Table X) representing the degree of tension and number of cases involved refer primarily to the localized tension in the affected part. It was extremely difficult, by the means used, to assess accurately the difference between the localized and general tension present. As a rule, however, the pain affected parts always showed appreciably more tension than the rest of the body. This could easily be demonstrated by palpation and the observable shortenings and stringiness found especially in the long muscles. In short and flat muscles the increased tension expressed itself in functional deformities, e.g. in the case of Rectus capitis major et minor - in "poking" head and in holding it towards one side, and in fine crepitus when palpated against the underlying bony surface. Passive movements also became more difficult when the affected parts were moved, e.g. in the case of pain in the shoulder, the unaffected shoulder could be brought more

TABLE XI

RELATIONSHIP OF PAIN AND TENSION AFTER TREATMENT

easily into passive movement; the affected, on the other hand, only with extreme difficulty especially at the beginning of treatment. In subjects in whom the onset was caused by mechanical factors, e.g. fracture, sprain, tear, etc. the tension seemed to be more localized.

With progress in improvement the amount of tension gradually diminished. Table XI shows the relationship between pain and tension at the end of treatment.

TABLE XI

DEGREE OF PAIN AND TENSION AFTER TREATMENT

		<u>Degree of Tension</u>					
		0	-1	1	1+	2	Totals
Degree of Pain	0	18	32	15	1		66
	-1	2	3	13	2		20
	1		2	3	8		13
	1+			1	3	1	5
	2				1	7	8
Totals		20	37	32	15	8	112

The Coefficient of Contingency was calculated from a 3 x 3 table (as shown below):

		<u>Degree of Tension</u>			
		0	1	2	Totals
Degree of Pain	0	18	48		66
	1	2	35	1	38
	2		1	7	8
Totals		20	84	8	112

$$C = \sqrt{\frac{P - 1}{P}}$$

$$C = 0.60$$

$$\sigma_c = \sqrt{\frac{1}{N}}$$

$$= 0.094$$

Garrett's correction:

$$C = \frac{C}{0.816} = 0.747$$

$$C.R. = \frac{C}{\sigma_c}$$

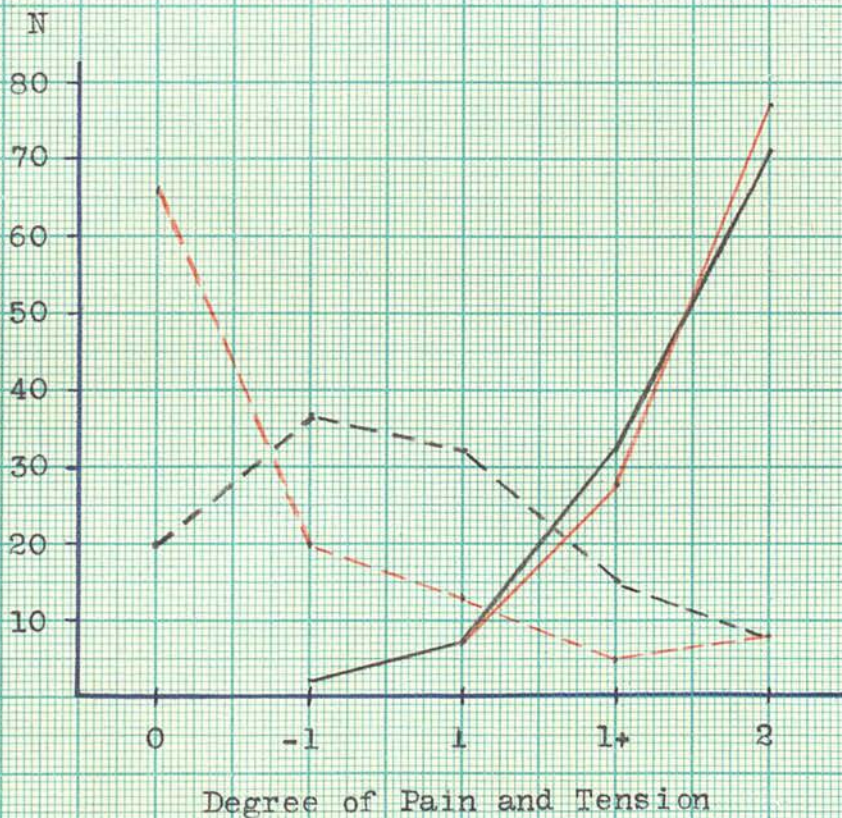
$$= 7.9$$

Figure 4

Degree of Pain and Tension Before and After Treatment

N=112

Pain Before Treatment Tension Before Treatment
- - - - - After - - - - - After



Experimental removal and reinduction of pain.

Removal of pain was carried out by relaxing the subject passively. After successful induction of relaxation the subject was allowed to move about, as much as he liked in order to find out whether pain was still present or not. The next step was reinduction of pain. This was done by means of modified resisted movements in which the affected muscles were brought into action or by sudden finger taps on an affected muscle, after which a "protective" spasm developed and pain was felt again, in exactly the same place as before, but to a different degree. It was never possible to induce pain in any subject by using these methods on a muscle which was not previously pain affected. Although it was not always possible to remove pain experimentally at the first attempt, it could always be reinduced immediately after the subject had responded to relaxation. With improvement, induction of passive relaxation became more easy and reinduction of pain more difficult. Table XII gives the data concerning removal and reinduction of pain.

TABLE XII

DEGREE OF PAIN AND NUMBER OF ATTEMPTS BY WHICH EXISTING
MUSCULAR PAIN WAS REMOVED AND REINDUCED IN A SAMPLE OF
112 SUBJECTS

Successful removal of pain by:	Degree of pain			Totals	Totals as %	Successful re-induction of pain by:
	2	1+	1			
1st attempt	51	18	7	76	67.9	1st attempt
2nd attempt	17	8	-	25	22.3	1st attempt
3rd and later attempts	9	1	-	10	8.9	1st attempt
Impossible	-	1	-	1	0.9	—
Totals	77	28	7	112	100%	

Figure 5

Experimental Removal of Pain, N=112

By		Accumulated Results
1st Attempt	67.9 %) 90.2%
2nd Attempt	22.3%	
3rd and Later Attempts	8.9%) 99.1%
Impossible	0.9%	

Onset of pain and factors involved.

Muscular pain occurred under three conditions:- after illness; after accidents; and "just came on" without any particular reason. Among factors which facilitated the onset were physical factors and psychological factors. There was usually more than one factor involved, but one of them seemed to be the setting off factor. Therefore, a division of these two groups into primary and secondary factors was made.

Table XIII shows the number of subjects and the factors involved in the onset of their pain.

TABLE XIII

ONSET OF PAIN AND FACTORS INVOLVED IN A SAMPLE
OF 112 SUBJECTS

How did it start?			Did a physical factor facilitate the onset?			Did a psychological factor facilitate the onset?			Unknown factors
After illness	After accidents	"Just came on"	Organic	Mechanical	Fatigue	Adaptive behavioural pattern in relation to external environment	Adaptive behavioural pattern in relation to internal environment	Bodily preoccupation	Bodily preoccupation combined with malingering
			<u>A s p r i m a r y</u>			<u>f a c t o r s :</u>			
5	16	91	5	23	-	83	-	-	1
			<u>A s s e c o n d a r y</u>			<u>f a c t o r s :</u>			
			8	3	41	7	28	38	24

Under the heading: Did a physical factor facilitate the onset? - in the column, "Organic", were included cases, such as a subject who had angina pectoris and afterwards developed muscular pain in his shoulder. In the column, "Mechanical", were included cases such as a subject who had an accident, e.g. bruising of a muscle, and afterwards developed pain, or a subject who had a very slight accident without any visible sign of physical damage and later developed pain. In this group were also included 7 cases who were diagnosed as having pain due to occupational causes, e.g. a subject's job required continuous bending and as a result he had pain in his back. These subjects could have been grouped under the next heading "Fatigue". But because they experienced pain only when performing particular work and their pain disappeared, as a rule, when keeping off such work, and, in addition, they exhibited no signs of general fatigue, these subjects were included in the "mechanical factor" group. The onset in these 7 cases was "just came on".

As a secondary factor, fatigue facilitated pain in 41 cases. In these cases fatigue expressed itself in affecting (not only one muscle or muscle group, due to overuse, but the entire physique.

Under the sub-heading "Adaptive behavioural pattern in relation to external environment", were included all those subjects who, during the interview and the administration of the Word Association Test, showed that they were in a stress situation produced by the external environment just before the onset of their pains. In other words they had a difficult problem to solve and they were set to solve it. This solving was accompanied by performing certain movements or assuming certain postures in relation to the external stress situation.

Under the sub-heading "Adaptive behavioural pattern in relation to internal environment", were included cases who showed a tendency to adapt themselves to an internal stress situation, such as pain due to organic causes or accidents. Three adaptive behavioural patterns could be observed in these subjects:

1. Avoidance (e.g. holding a limb in a certain position not to "cause" pain).
2. Withdrawal, (e.g. contracting certain muscles in order to "withdraw" from a painful experience).
3. Protection (e.g. adducting the shoulder during an attack of angina pectoris).

No case has been classified under the heading

"Adaptive behavioural pattern in relation to internal environment", as the primary onset factor; 28 cases were included, however, under this heading as a secondary onset factor. These 28 cases included 5 cases of organic onset, 16 cases of mechanical onset and 7 cases whose onset was due to occupational factors.

Although there have been included in this group only cases in which this factor was extremely prominent, nevertheless, all cases without exception, displayed to a greater or lesser degree^a pattern of behaviour adaptive to existing or anticipated pain. This took place, as a rule, in the form of either "protection", "avoidance" or "withdrawal".

The adaptive behavioural pattern in relation to internal environment was assessed on the basis of the subjects' assumed functional postures, associated movements and reflex actions in the event of a sudden introduction of pain.

Under the heading of "Bodily Preoccupation", were grouped cases who, as a result of pain experience in the past, were "interested" in their bodily functions and

their well-being to such a degree that their behaviour became "pain centred". They displayed an exaggerated concern over parts of the body, which were thought by them, to be at fault, eg. having pain in the back, ("Oh, it must be my spine or cancer of my bowels"); having pain in the chest wall, ("Oh, it must be my heart, or lungs or tuberculosis"). The last of all the organs or tissue to be accused of being affected or diseased were the muscles themselves. Twenty-nine out of the 38 cases (70%) when assured that it was the muscle itself at fault, because it was in continuous contraction, had the pain eased completely.

Although only 38 cases of the sample displayed habitual excessive bodily preoccupation, all subjects showed concern about their well-being to a certain degree. This degree of bodily concern was closely related to anxiety, i.e. anticipated danger, e.g. "Will I ever get better?" In no case could bodily preoccupation be regarded as a primary onset factor.

Malingering.

Although this factor stands in close relationship to bodily overconcern, it was found necessary to regard

TABLE XIV

DEGREE OF PAIN AND BODILY PREOCCUPATION. N = 112.

malingering as a separate factor. Bodily preoccupation is exercised for the sake of well-being itself: malingering, however, expresses in addition, some overt or covert desire to gain (a) protection and sympathy, (b) exemption or escape, or (c) privileges and rewards (compensation). In no subject of the sample was malingering a primary pain-producing factor. In 24 cases, however, malingering was a secondary factor in producing pain.

Taking into consideration the number of subjects with "pure" bodily preoccupation (38) and the number of subjects with bodily preoccupation "superimposed" by malingering (24), altogether in 62 cases bodily overconcern was a secondary factor in muscular pain facilitation. The obtained results are tabulated in Table XIV.

$$Q = 0.505$$

$$= 0.094$$

Garratt's correction

$$Q.R. = \frac{Q}{50}$$

$$Q = 0.815 = 0.742$$

$$= 7.0$$

DEGREE OF PAIN AND BODILY PREOCCUPATION. N = 112.

		Degree of bodily preoccupation				Totals
		-1	1	1+	2	
Degree of Pain	-1					
	1	2	5			7
	1+	2	4	18	4	28
	2		8	11	58	77
Totals		4	17	29	62	112

The Coefficient of Contingency was calculated from a 3 x 3 table (as shown below):

		Degree of bodily preoccupation			Totals
		-1 or 1	1+	2	
Degree of Pain	-1 or 1	7			7
	1+	6	18	4	28
	2	8	11	58	77
		21	29	62	112

$$C = \sqrt{\frac{P-1}{P}} \qquad \sigma C = \frac{1}{\sqrt{N}}$$

$$C = 0.606 \qquad \qquad \qquad = 0.094$$

Garrett's correction:

$$C = \frac{C}{0.816} = 0.742 \qquad \qquad \qquad C.R. = \frac{C}{\sigma C} = 7.8$$

Disruption and Adjustment of Behaviour.

Adjustive behaviour may only take place when some disruption of behaviour has occurred. Thus the first question that must be considered is what was the nature of the disruption; the second, what objective measurement can be employed to show that such disruption took place or was still taking place; and the third question, how did the subject try to adjust his behaviour to the newly encountered conditions.

1. NATURE OF DISRUPTION.

There were altogether, 28 cases in which the causative factor of onset of pain was physical. In 5 cases the factor was organic, producing pain, discomfort or disfunction in some organ. The adaptive behavioural pattern in these subjects was mainly protection of the diseased organ and avoidance of further pain. In 23, the causative factor was mechanical, (pain or mechanical disarrangement due to accidents or overuse). Here, withdrawal and avoidance behavioural patterns were dominant. In 83 cases of the sample the facilitating factor of onset of pain was psychological, namely a stress situation of recent origin in the external environ-

ment. It was impossible to assess quantitatively these behavioural disrupting situations since an evaluation of such situations depends entirely on the person himself, on his evaluation in the light of his past experiences, his expectations and his future anticipations. Even a generalisation as to the nature of the stress situation itself appeared to be very problematic. Every stress situation seemed to be unique and related entirely to the individual himself. These stress situations comprised domestic troubles, occupational and business difficulties and personal affairs.

2. OBJECTIVE MEASUREMENT OF DISRUPTION

In order to assess objectively the degree of the subject's disruption of behaviour, the following were taken into account:

- (a) The amount, intensity and duration of autonomic (nervous system) disturbances.
- (b) Affective actions.
- (c) Intensification or disorganisation of effective behaviour, (motor or verbal).

This disruption was assessed by interview supplemented by the Hy scale of the M.M.P.I. The obtained results are shown in Tables XV and XVI.

TABLE XV

DEGREE OF PAIN AND DISRUPTION OF BEHAVIOUR. N = 112.

		Degree of disruption of behaviour				
		-1	1	1+	2	Totals
Degree of Pain	-1					
	1	2	3	2		7
	1+	1	3	20	4	28
	2		3	8	66	77
Totals		3	9	30	70	112

The Coefficient of Contingency was calculated from a 3 x 3 table (as shown below):

		Degree of disruption of behaviour			
		-1 or 1	1+	2	Totals
Degree of Pain	-1 or 1	5	2		7
	1+	4	20	4	28
	2	3	8	66	77
Totals		12	30	70	112

$$C = \sqrt{\frac{P - 1}{P}}$$

$$C = 0.634$$

$$G_c = \frac{1}{\sqrt{N}}$$

$$= 0.094$$

Garrett's correction:

$$C = \frac{C}{0.816} = 0.776$$

$$C.R. = \frac{C}{G_c}$$

$$= 8.2$$

TABLE XVI

OUTSTANDING AUTONOMIC DISTURBANCES AND AFFECTIVE ACTIONS
DISPLAYED BY SUBJECTS WITH MUSCULAR PAIN. N = 112.

Disturbances	In subjects of psycho- logical onset N = 83	%	In subjects of physical onset N = 28	%
Sleep distur- bances	76	91.6	22	78.6
Headaches and weariness	75	90.4	16	57.1
Restlessness	66	79.5	17	60.7
Fatigue	62	74.7	10	35.7
Excessive worry	54	65.1	12	42.9
Constipation	51	61.4	11	39.3
Muscle twitching	49	59.6	9	32.1
Tingling, burning and "going to sleep" sensat- ion	42	50.6	11	39.3
Boredom and depression	38	45.7	4	14.3
Precordial pain	35	42.2	5	17.9
Stomach trouble	34	41.0	11	39.3

3. ADJUSTIVE BEHAVIOUR

Data concerning the third question: how did the subject try to adjust his behaviour in his new conditions, will be presented by indicating at the same time:

- (a) the form of environmental stress;
- (b) the outstanding behavioural tendencies in the

subject's personality.

- (c) the pain-affected muscles and their main actions.

Tables XVII and XVIII show the above enumerated relationships in (a) psychological and (b) physical facilitation of pain.

Counteraction
 Defence
 Achievement
 Inavoidance

Defence
 Achievement
 Autonomy
 Dominance
 Succorance
 Inavoidance
 Counteraction
 Retention

TABLE XVII

ADJUSTIVE BEHAVIOURAL TENDENCY IN PSYCHOLOGICAL FACILITATION
OF PAIN. N = 112.

Muscles involved	No. of cases	Main action of involved muscles	Form of environmental stress	Subject's behavioural tendency towards the stress situation	Accompanying covert behavioural tendency	Outstanding behavioural tendency as assessed on Murray's behaviour variables	No. of cases with high scores
<u>P A I N I N N E C K .</u>							
Rectus capitis posterior major et minor	7	Extend the head (head retraction) and turn the face towards the same side.	1. A task 2. A rival	1. To master it rapidly and as well as possible 2. To rival and surpass others. To be the first, to be "on top", to be above everyone and everything	To keep the head high	Achievement Autonomy Dominance Aggression Defendance	7 5 4 3 2
Levator scapulae	3	The cervical part of the vertebral column being fixed, it elevates the scapula.	Failure	To make up for failure by restriving	To "pull" oneself out of difficulty, to elevate oneself by shrugging the shoulder	Counteraction Defendance Achievement Infavoidance	3 2 2 1
<u>P A I N I N S H O U L D E R .</u>							
Supraspinatus and Deltoid	21	Abduction of shoulder and also flexion and extension of arm.	1. Aggression 2. Assault 3. Belittlement 4. Censure 5. Criticism 6. Blame	To defend oneself against depreciating and belittling judgements.	To assume a defending and forceful posture	Defendance Achievement Autonomy Dominance Succorance Harmavoidance Counteraction Retention	20 13 9 9 3 3 2 2

Continuation:- ADJUSTIVE BEHAVIOURAL TENDENCY IN
PSYCHOLOGICAL FACILITATION OF PAIN.

Muscles involved	No. of cases	Main action of involved muscles	Form of environmental stress	Subject's behavioural tendency towards the stress situation	Accompanying covert behavioural tendency	Outstanding behavioural tendency as assessed on Murray's behaviour variables	No. of cases with high scores
<u>P A I N I N A R M.</u>							
Extensors of the wrist: Extensor carpi radialis longus et brevis: Extensor carpi ulnaris	5	Fixation and extension of wrist.	Threat of deprivation	To refuse to give, to withhold.	To grip tightly	Retention Acquisition Achievement Autonomy Rejection	4 2 2 2 1
Flexors of the wrist: Flexor carpi ulnaris, Flexor carpi radialis	2	Flexion of Wrist.	Obstacles preventing gain of possessions and property	To grasp, to snatch, aggressively acquiring possessions.	To grasp	Acquisition Achievement Aggression	2 2 1
<u>P A I N I N C H E S T W A L L.</u>							
Serratus anterior	5	Abduction and upward rotation of scapula.	Repellent person, object or situation	To separate oneself from an unpleasant or undesirable object or situation	To push away	Rejection Harmavoidance Infavoidance Aggression Succorance	5 3 3 2 2
Diaphragm and Sterno-costalis	5	Muscles of "inspiration" and also support expulsion e.g. sneezing, laughing, crying.	1. Loss of someone dear 2. Being rejected	To crave for affection, tenderness and recognition	To adopt a pathetic and tragic appearance	Succorance Harmavoidance Abasement Infavoidance Blamavoidance Rejection	5 4 2 2 1 1

Continuation:- ADJUSTIVE BEHAVIOURAL TENDENCY IN
PSYCHOLOGICAL FACILITATION OF PAIN.

Muscles involved	No. of cases	Main action of involved muscles	Form of environmental stress	Subject's behavioural tendency towards the stress situation	Accompanying covert behavioural tendency	Outstanding behavioural tendency as assessed on Murray's behaviour variables	No. of cases with high scores
<u>P A I N I N B A C K .</u>							
Quadratus lumborum	18	Elevation of pelvis (reversed action) and trunk flexion. Abduction of thigh with internal rotation (from flexed position).	Rejection	To avoid situations which may lead to a lowering of self-regard	To shrink	Infavoidance	16
Tensor fasciae latae			Failure			Succorance	8
			Belittlement			Blamavoidance	6
			Ridicule			Autonomy	6
Psoas and Iliacus	6	Hip flexion.	Opposition Annoyances Attacks Insults	To overcome opposition forcefully	To kick	Aggression	6
						Dominance	4
						Defendance	3
						Achievement	3
						Autonomy	2
						Infavoidance	2
						Harmavoidance	1
<u>P A I N I N K N E E .</u>							
Vastus intermedialis	1	Knee extension.	A s u n d e r	P s o a s a n d I l i a c u s .			
<u>P A I N I N G L U T E A L R E G I O N .</u>							
Biceps femoris Semitendinosus Semimembranosus	10	Knee flexion.	Censure Retribution from Society	To avoid blame or rejection	To escape To run away	Blamavoidance	9
						Succorance	6
						Inferiority	5
						Defendance	4
						Nurturance	3
						Harmavoidance	2
						Autonomy	1

TABLE XVIII

ADJUSTIVE BEHAVIOURAL TENDENCY IN PHYSICAL FACILITATION
OF PAIN

Muscles involved	No. of cases	Main action of involved muscles	Form of environmental stress	Subject's behavioural tendency towards the stress situation	Accompanying covert behavioural tendency	Outstanding behavioural tendency as assessed on Murray's behaviour variables	No. of cases with high scores
<u>WHEN ORGANIC FACTORS WERE OPERATING.</u>							
Scattered	5	Various.	Pain and discomfort	To improve. To get rid of the trouble.	To protect. To avoid pain.	Harmavoidance Infavoidance Defendance Succorance Compassion	5 3 3 2 1
<u>WHEN MECHANICAL FACTORS WERE OPERATING.</u>							
Scattered	23	Various.	Pain.	To improve. To be cautious. To be careful.	To protect. To withdraw. To avoid.	Harmavoidance Infavoidance Succorance Nurturance Defendance Dominance Autonomy Achievement Blamavoidance Acquisition	18 8 6 6 5 4 4 4 3 2

Assessment of "Cure".

This was done by the consultant physicians and surgeons who in the first place diagnosed the subjects as suffering from muscular pain.

The consultant physicians and surgeons as a rule did not know who treated the subjects in the Physiotherapy Department, (staff of 10). Thus this assessment can be regarded as unbiased.

The experimental group in addition to their physiotherapy received further treatment in the form of "desensitization" by means of:

- (a) disruption of the acquired motor behavioural patterns (excessive localized muscular contractions) by induction of relaxation first passively, then actively by the subject himself;
- (b) reassurance (supportive therapy);
- (c) insight into causative factors of excessive muscular contraction. This was to allow for self-adjustment to changed internal or external environmental situations.

The obtained results on assessment of cure were as follows:

1. TAKING INTO ACCOUNT THE
DEGREE OF RECOVERY:

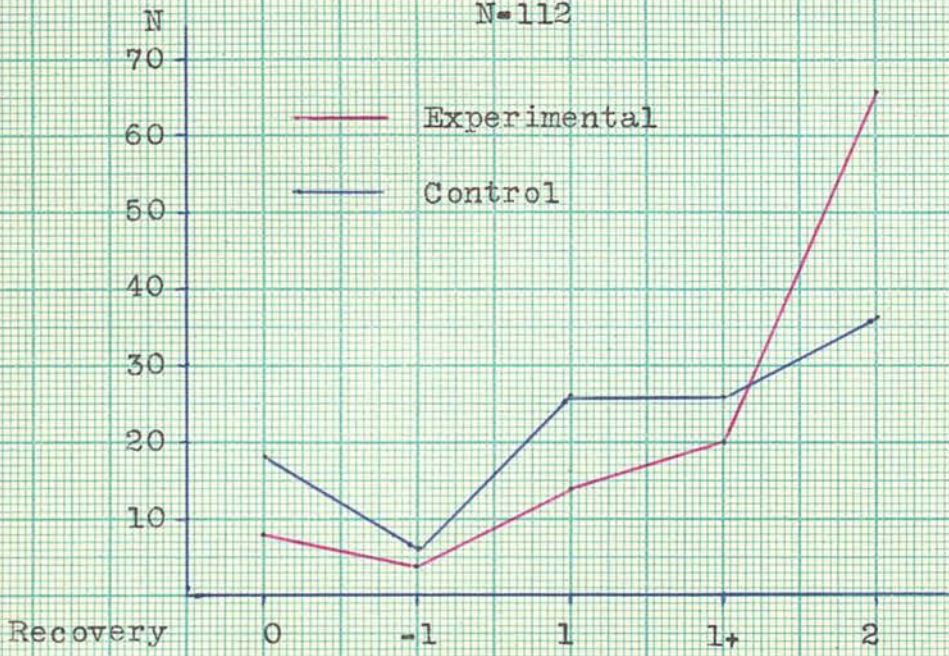
TABLE XIX

DEGREE OF RECOVERY IN EXPERIMENTAL AND CONTROL GROUP.
N = 112.

Degree of Recovery		Experimental Group	Control Group
In status quo or no improvement	= 0	8	18
Slightly improved	= -1	4	6
Improved	= 1	14	26
Much improved	= 1+	20	26
Free from pain or cured	= 2	66	36
Totals		112	112

$$\chi^2 = 17.44; \quad df = 4; \quad P < 0.01$$

Figure 6
Degree of Recovery in Experimental and Control Group
N=112



N.B. Code of recovery as in Table XIX, p. 118.

2. TAKING INTO ACCOUNT THE TIME IN WHICH RECOVERY TOOK PLACE:

N.B. The degree of recovery has been disregarded here. As it can be seen from the previous table it is in favour of the experimental group.

TABLE XX

TIME IN WHICH RECOVERY IN THE EXPERIMENTAL AND CONTROL GROUP TOOK PLACE.

No. of days in which recovery took place	No. of Subjects in	
	Experimental Group	Control Group
1 - 10	9	2
11 - 20	41	5
21 - 30	24	11
31 - 40	15	17
41 - 50	7	8
51 - 60	5	15
61 - 70	1	9
71 - 80	-	7
81 - 90	2	3
91 - 100		3
101 - 110		3
111 - 120		2
121 - 130		3
131 - 140		3
141 - 150		3
Totals	104	94

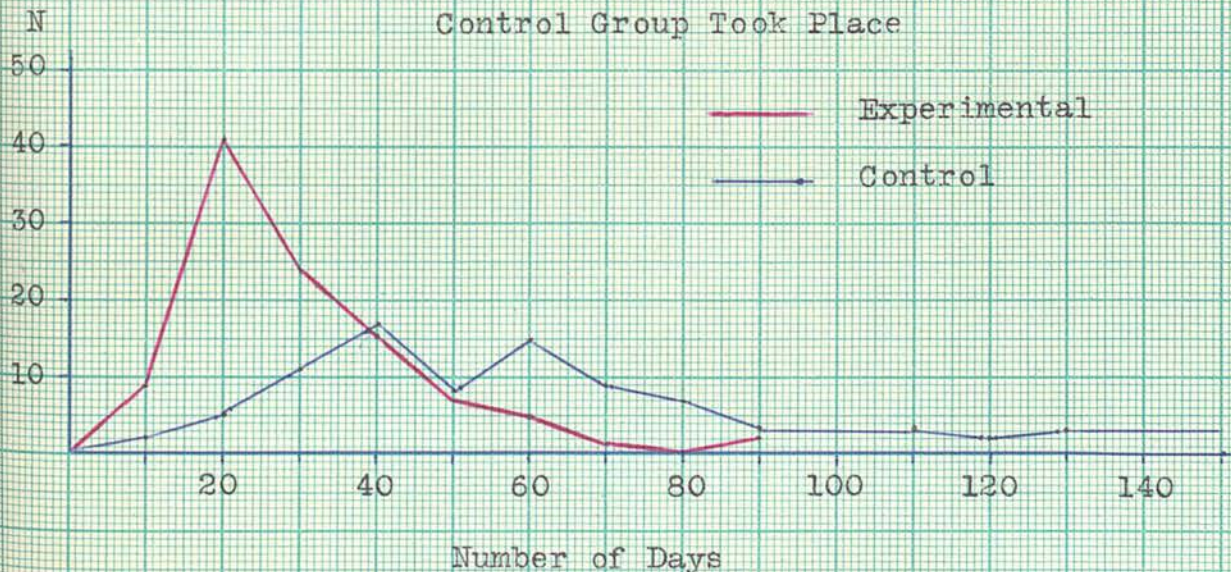
N.B. From these figures the number of cases in whom there was "0" cure, are omitted (8 cases from Experimental and 18 cases from Control Group).

Statistical findings with regard to the time of recovery were as follows:

<u>Experimental Group</u>	<u>Control Group</u>
M = 25.02 days	M = 59.54 days
$\sigma = 15.62$	$\sigma = 34.60$
$\sigma_M = 1.49$	$\sigma_M = 3.46$
$\sigma_{Diff} = 3.76$	
C.R. = 8.96	

Figure 7

Time in Which Recovery in the Experimental and Control Group Took Place



3. TAKING INTO ACCOUNT THE NUMBER OF ATTENDANCES FOR TREATMENT IN WHICH CURE WAS OBTAINED:

TABLE XXI

NUMBER OF ATTENDANCES FOR TREATMENT IN WHICH RECOVERY TOOK PLACE.

No. of Attendances	No. of Subjects in	
	Experimental Group	Control Group
1 - 5	28	2
6 - 10	44	21
11 - 15	19	19
16 - 20	11	22
21 - 25	1	10
26 - 30	1	11
31 - 35		5
36 - 40		1
41 - 45		2
46 - 50		1
	104	94

N.B. The degree of recovery again has been disregarded and the number of cases with "0" improvement omitted.

Statistical findings with regard to the number of attendances for treatment were as follows:

Experimental Group

Control Group

M = 8.96 attendances

M = 18 attendances

σ = 5.19

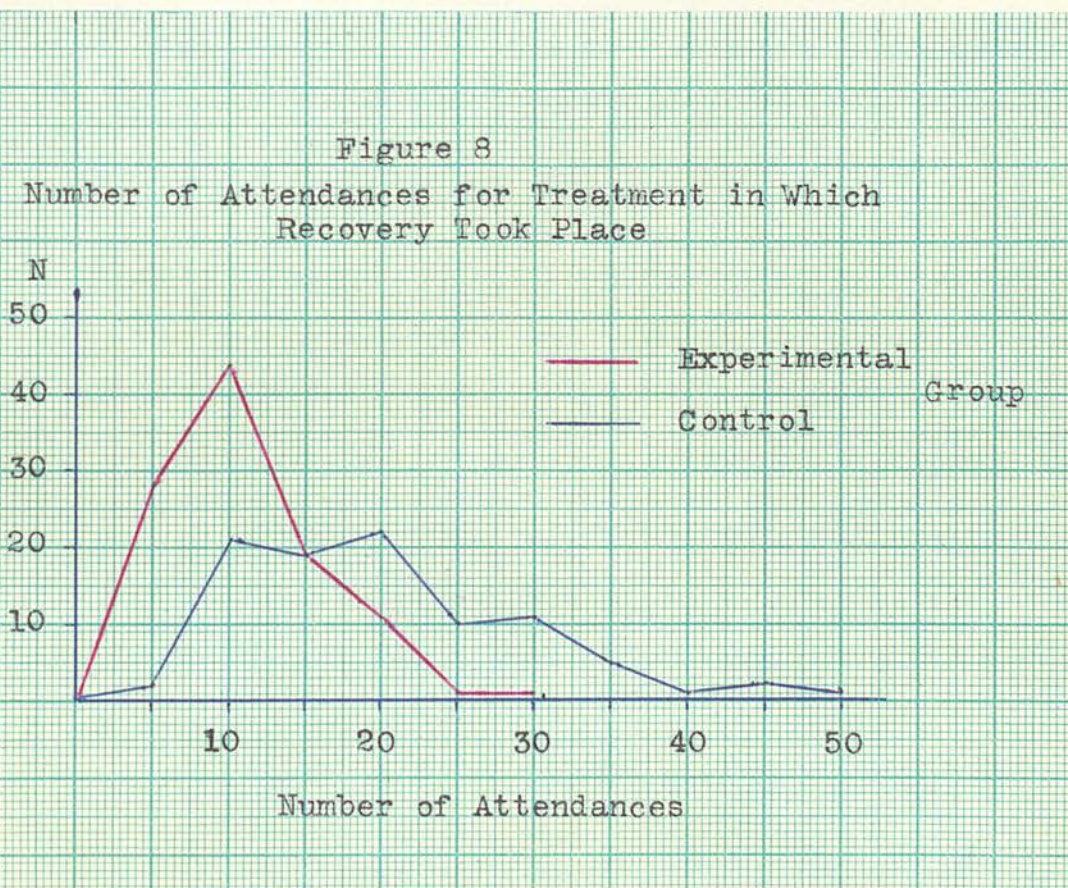
σ = 9.25

σ_M = 0.5

σ_M = 0.91

σ_{Diff} = 1.03

C.R. = 10.64



SECTION VII

INTERPRETATION AND DISCUSSION OF RESULTS

The hypothesis tested was that some muscular pains, described clinically as fibrositis, muscular rheumatism, myositis, myalgia, lumbago, brachial neuritis, pleurodynia, etc. are evoked by muscular tension brought about by covert behaviour.

The literature on muscular pains is extensive. It dates back to 1904, when Sir William Gowers introduced the term "fibrositis", demonstrating inflammatory changes in fibrous tissue which he felt were responsible for lumbago.

The cause of muscular pains continues to be a controversial subject.

As mentioned before somatic muscles are almost if not completely painless to cutting, burning, scratching or piercing with a needle (Lewis, 1942). Also the investigation described on page 20 and empirical observation, support this phenomenon.

Why is it then that under certain conditions muscles become pain sensitive?

Clinical investigations agree that the "syndrome" of muscular pains may be initiated by many factors, and it has been suggested that injury, infection, exposure, fatigue and vascular, metabolic, postural, occupational and psychogenic conditions may be pain-evoking factors. A detailed review of the clinical literature reveals a number of authors vehemently defending a variety of theories on the causes of pains but in most cases these theories lack objective support which could be accepted in the light of neuro-physiological findings and psychological interpretations.

Investigators who have conducted their studies on the subject of muscular pains along physiological or psycho-physical lines, have put forward more specific theories. Lewis (1942) attributed muscular pains to a "P" or pain factor a product of muscular contraction, which is directly or indirectly responsible for pain. Hardy et al. (1952) postulated that muscular pain is due to noxious stimulation, through the destruction of tissue.

Assuming that pain is a sensation, none of these investigators working on either clinical or psychophysical lines has given a full explanation of what the "true" stimulus producing this sensation is, nor have they identified and explained the involved neuro-physiological mechanism.

MUSCULAR TENSION

There is, however, unanimous agreement among all investigators that muscular pain is accompanied by contraction (tension), tenderness and stiffness of the affected muscles.

It will be remembered, that "muscular tension" in evoking muscular pain, is the basic proposition of the hypothesis tested.

That muscular contraction produces pain can be demonstrated most readily, when a muscle contracts excessively as happens in "cramp", most frequently observed in calf muscles. Pain is experienced in this phenomenon a few seconds after the muscle has gone into spasm, and vanishes as soon as the muscle returns to its normal condition. Such pain cannot be dependent on the

accumulation of the metabolic products to which muscular pain is sometimes attributed.

Dealing with the clinical entity muscular pain, one has to distinguish between (a) acute pain - lasting for several minutes, and (b) chronic pain - lasting for hours or even days. In the pain experience described as acute the entire muscle in question appears to be in spasm. In the chronic pain experience, only a few muscle fibres seem to be contracted at a time. These few muscle fibres most probably form the so called "motor unit", in which a group of muscle fibres is gathered together in a bundle, covered by a sheath of connective tissue and supplied by one motor neurone (Morgan et al, 1950). It is known that these motor units are able to function a few at a time - in relays.

In order to secure objective evidence that muscular pain could be due to muscular tension three different methods of measurement were employed:

(1) Statistical. The degree of pain was correlated with the degree of present tension.

The relationship between these two phenomena before treatment determined by the Contingency Coefficient was

$C = 0.820$; $\sigma_c = 0.094$; and $C.R. = 8.7$. These results indicate that there is a highly significant relationship between muscular pain and muscular tension.

On completion of treatment, the correlation between pain and tension was $C = 0.747$; $\sigma_c = 0.094$ and $C.R. = 7.9$. One would have expected that the same degree of correlation between muscular tension and pain would have remained after treatment, that is - no pain, no tension. These figures, (especially when inspecting the contingency table), however, show that some tension was still present even if there was no pain.

Jacobson (1929) reported that after a subject had relaxed in the proper sense, there remained, as a rule, a certain degree of tension which he called "residual tension". This then would explain why many subjects in the sample still showed some tension, even if there was no pain.

(2) Experimental removal of pain by means of inducing relaxation.

As soon as relaxation was obtained, muscular pain vanished. The measurement employed here was the measurement of Probability - p , which represents a ratio of the

Total number of occurrences
Total number of trials

The obtained results were: pain removed by:

	accumulated results
first attempt, p = 0.679)	p = 0.902
second attempt, p = 0.223)	
third attempt, p = 0.089)	

p = 0.991

It can be seen from these figures that in practically all cases properly diagnosed muscular pain could be removed by relaxation. Only in one case $p = 0.009$ was it impossible to remove pain experimentally. This subject, however, appeared not to suffer from muscular pain. (After three weeks of unsuccessful treatment, she was re-directed to the Ear, Nose and Throat Department).

It should not be assumed, however, that when the pain had been removed by relaxation, it did not re-occur spontaneously at a later occasion during the same, or next day. Usually with every treatment, pain experience, after inducing relaxation, became less frequent and less severe, until finally this pattern of behaviour (localized muscular contraction) was completely eliminated. At the same time, also, some physiological changes in the affected muscles probably took place.

(3) Experimental reinduction of pain.

This was done by means of modified resisted movements and by giving sharp taps with the fingers on the affected muscle bellies. (During this procedure the muscle was brought back into contraction).

Pain could always be reinduced as soon as a subject responded to relation. With improvement, induction of passive relaxation (experimental removal of pain) became easier, reinduction of pain, however, more difficult.

It must be stressed that in any subject who did not suffer from muscular pains, was it ever possible to induce pain experimentally using these methods. This applies equally to subjects suffering from muscular pains, but in whom it was tried to induce pain in a sound muscle group.

That muscular tension is responsible for evoking muscular pain, can also be inferred from the fact, that whenever during the course of treatment there was fluctuation of pain severity, muscular tension - (especially localized tension) varied accordingly. It increased with increase of pain and decreased with decrease of pain. This happened in 97.1% of cases of the sample.

As to the technique of measurement of tension, although a rather crude measurement was employed - namely rating of the subjects' displayed physiological and behavioural variables instead of a finer measurement such as the "action potential" technique, this nevertheless, produced unbiased results. First, there is no agreement as to which muscle group adequately reflects the degree of general muscular tension (Wenger, 1943); secondly - application of needle electrodes in order to assess localized tension would undoubtedly upset the majority of subjects and produce a higher reading of registered potential currents; and thirdly - even application of plate electrodes to a superficial muscle e.g. Deltoid would also distort to a certain degree the presence or absence of action potentials. This would be due to the subject's expectation that "it might hurt". (This happens even if a subject is sufficiently reassured that it will not hurt). The anticipation of pain would in turn produce a readiness to "withdraw" or to "protect" (a postural attitude) and the final result would be an increase in tension.

The experimental removal and reinduction of pain appeared to be most impressive to the subjects. The

usual expectation in order to ease pain, is to take a "tablet" or get an injection. By using the simple techniques of experimental removal and reinduction of pain, subjects' "self-realisation" provided them with a reassurance that their complaint was not serious nor dangerous, and also gave them unquestionable confidence in the therapist. This confidence was utilised most carefully by the therapist when dealing with the subject's personality and recent environmental stress assessment.

Experimental removal and reinduction of pain became also a useful starting point in the treatment itself. The existing motor pattern of behaviour could be disrupted first by the therapist and later by the subjects themselves. This experiment in most cases provided the subjects with some "hints" about their pain causation, i.e. "Why is it that relaxation removes pain?" This in turn provoked a spontaneous discussion, during which the subjects were given an opportunity to gain insight into their muscular pain causation. Some subjects being freed from pain by passive relaxation did not show much interest in the "why" but demanded straightforward reassurance, that the pain would not return anymore.

In conclusion of the subject on muscular pain and muscular tension, the obtained evidence points to an acceptance of the proposition that muscular pain is evoked by muscular tension.

COVERT BEHAVIOUR

Covert behaviour, as the factor responsible for evoking muscular tension, is the second proposition of the hypothesis tested.

There seems to be ample evidence that covert behaviour is in intimate relationship with any activity which is called forth by meeting a problem situation, in dealing with which one is unable to express oneself freely. In such situations, according to Humphrey (1951), we rather tend to take up a postural attitude towards them, and this attitude is of implicit rather than of explicit nature.

The present investigation showed, that in relation to muscular pains, two kinds of covert behaviour were operating. Firstly, there was covert behaviour which expressed itself in the form of: (a) "protection" of a painful organ or part of the body; (b) "withdrawal" from painful

stimulation existing in the subject himself, e.g. after accidents; (c) avoidance of pain.

Secondly, there was covert behaviour that appeared to be an accompaniment of "problem solving" behaviour, in which free expression to a certain degree was hampered. The subject was forced to "think" rather than to "act" in solving his difficult problem.

It is quite obvious that in our social setting, we daily encounter many situations, in which free expression is restrained. But not all restraint necessarily results in such a degree of implicit muscular contraction that it becomes pathological.

Here then, arises a fundamental question: when is such covert behaviour most likely to produce ill effects?

The answer on the basis of the present investigation appears to be when an individual lives in a prolonged stress situation, produced by the external or internal environment, which he tries to overcome by repeated efforts.

The next logical question would be: why does an individual not give up his repeated efforts in solving a

problem, which is far beyond his effective means? A speculative answer to this question was suggested by Snygg et al. (1949), that behaviour tends to be organised according to the needs of an individual. Any disruption of it is met by continuous efforts to restore and maintain an individually determined relationship between himself and the world about him.

STRESS SITUATIONS AND COVERT BEHAVIOUR

In 28 subjects in the present sample, the facilitating factor of onset of pain was physical. These subjects were confronted with an internal stress situation. In 5 subjects the internal stress situation was an organic disease, in 16 subjects an injury, and in 7 subjects overuse of certain locomotor structures.

Their covert behaviour pattern expressed itself in the form of protection of the affected organ or discomfort-producing mechanical structure, avoidance of pain and withdrawal from a painful situation.

In 83 cases the facilitating factor of onset of pain was psychological. Here the stress situation lay in the external environment. These subjects were confronted

with a difficult problem (from their point of view), which disrupted their normal behaviour and required readjustment.

Among these subjects two main covert behavioural tendencies were observed, one directed towards the problem (to attack, to overcome, to solve) and the other directed away from the problem (to withdraw, to shrink, to escape from an unbearable situation).

The obtained correlation ($C = 0.776$; $\sigma_C = 0.094$; C.R. = 8.2) between subjects' muscular pain and their disruption of behaviour indicates that there was a fairly close and highly significant relationship between these two. Thus strong support for the contention that prolonged stress situations are the main factors in evoking localized muscular tensions by way of covert behaviour, was obtained.

PERSONALITY FACTORS AND COVERT BEHAVIOUR

The present investigation revealed that there was a close link between covert behaviour, personality, make-up and site of pain.

Personality, for the purpose of this research, was conceived as a functional unit and only the outstanding dispositional tendencies, which according to Klein et al. (1951) determine and qualify the patterning of behaviour, were taken into account. Such a conception of personality made it possible to study it in the context of motivational behaviour (Postman, 1953) and unravel the reasons for an individual's overt or covert reactions.

There seems to be sufficient evidence to show that any mental behaviour is accompanied by motor reactions (Jacobson, 1929; Courts, 1942; Humphrey, 1951). The accompanying motor behaviour becomes specially prominent when an individual is dealing with an unusual task (stress situation). If, in such a case, an individual is not allowed to express himself freely, his motor behaviour may increase to such an extent that it may become dangerous to its surroundings, as happens, for example, in states of anger.

In our present social setting, such free expression is not tolerated, therefore motor reactions usually take the form of covert behaviour.

The evidence obtained from this research showed that

covert motor behaviour is an inseparable part of the dispositional tendencies displayed by the individual. The site of pain (in psychological facilitation) was always in close correspondence, not only with the subject's main action towards a stress situation, but with the stress situation itself, e.g. pain in neck was found in ambitious subjects who, when confronted with a rival (environmental stress situation), tried to surpass him by prolonged efforts.

It would be interesting to put to scientific test whether the opposite also holds good. That is, whether by knowing the site of pain, (muscular structures involved) the subject's pertinent pattern of behaviour and environmental stress could be predicted.

Of the 28 cases in which a physical factor facilitated the onset of pain, 23 subjects displayed the behaviour variable described by Murray as "harmavoidance". They showed apprehension, fear, anxiety, caution and took care not to hurt themselves. They tried to avoid pain by all means and took suitable precautionary measures. Their general behavioural pattern was to avoid danger, to be cautious and hesitant about undertaking anything or to evade or shrink from a perilous situation.

Pain in this group was not confined to any particular muscle or muscle group. The muscles involved were those which protected a diseased organ or an injured part of bone, ligament or muscular structure.

Among the 83 subjects of the sample whose pain was facilitated by psychological factors, definite muscles or muscle groups were involved. The muscles affected are enumerated in the following section under the headings of the anatomical regions in which pain was felt.

PAIN IN NECK

The main muscles involved were:

(a) Rectus capitis major et minor, whose function is to extend (retract) the head and turn the face towards the same side.

(b) Levator scapulae, whose function is: to raise the superior angle of the scapula if the cervical part of the vertebral column is fixed (shoulder shrugging).

In subjects who experienced pain in the Rectus Capitis major et minor, the environmental stress was a task or a rival, and their behavioural tendency towards the stress situation was intense and prolonged efforts to master it

rapidly and as well as possible or to rival and surpass others, to be the first, to be on top or to be above everyone and everything. The accompanying covert behavioural pattern here tended towards keeping the head high. In these subjects their predominant dispositional tendencies, assessed on Murray's behaviour variables, were "achievement", "autonomy" and "dominance". They displayed ambition, independence and confidence and an attitude to master a situation, to overcome obstacles and to attain a high standard; to be independent, and to influence or direct the behaviour of others.

In subjects who experienced pain in the Levator scapulae the prevailing environmental stress was failure. Their behavioural tendency towards the stress situation was to make up for a failure by re striving, to obliterate a humiliation by resumed action. The accompanying covert behavioural pattern here was "to pull oneself out of difficulty, to evaluate oneself by lifting (shrugging) the shoulder". In these subjects the outstanding dispositional tendency, assessed on Murray's behaviour variables, was "counteraction". They displayed a feeling of shame after failure and zest for re striving and an attitude to maintain self-respect and pride on a high level.

PAIN IN SHOULDER

(a) Extensors of the wrist - their main function is to extend the wrist. The muscles involved were: Supraspinatus and Deltoid, whose main function is to abduct the shoulder and also to flex and extend the arm.

In subjects who experienced pain in the Supraspinatus and Deltoid, the environmental stress was found to be aggression, assault, belittlement, censure, criticism, blame; and their behavioural tendency towards the stress situation was to defend themselves against depreciating judgements. (Such sayings as: "He is on his guard; he bristles when criticised; he has a chip on the shoulder; he is ready with excuses; he argues back" etc., have a ready application). The accompanying covert behavioural pattern was the assumption by the subjects of a defending and forceful posture. In these subjects, the outstanding dispositional tendency, assessed on Murray's behaviour variables, was "defendance". They displayed a feeling of anxiety and indignation and an attitude of self-defence.

PAIN IN ARM.

The muscles involved were:

(a) Extensors of the wrist - their main function is fixation and extension of the wrist and thereby tightening the grip.

(b) Flexors of the wrist - their main function is flexion of the wrist.

In subjects who experienced pain in the extensors of the wrist the predominant environmental stress was threat of deprivation of material objects or dear persons. Their behavioural tendency towards the stress situation was to refuse to give or to withhold. The accompanying covert behavioural pattern was to grip tightly. In these subjects, the outstanding dispositional tendency, assessed on Murray's behaviour variables, was "retention". These subjects showed a feeling of anxiety "not to lose" and an attitude "not to be deprived of some possessions".

In subjects who had pain in the flexors of the wrist, the environmental stress was obstacles in the way of preventing gain of possessions or property. Their behavioural tendency towards the stress situation was to grasp, to snatch, or aggressively acquire possessions. The accompanying covert behavioural pattern was to "grasp" or to "grab". In these subjects, the outstanding

dispositional tendency, assessed on Murray's behaviour variables, was "acquisition". They displayed a feeling of anxiety to gain and an attitude of "hoarding".

PAIN IN CHEST WALL

The muscles involved were:

(a) Serratus anterior whose main action is abduction and upward rotation of the scapula.

(b) Diaphragm and Sterno-costalis. These are muscles of "inspiration". They also support expulsion, e.g. sneezing, coughing, crying.

In subjects who experienced pain in the Serratus anterior, the environmental stress was a repellent person, object or situation. Their behavioural tendency towards the stress situation was to separate themselves from an unpleasant or undesirable object, person or situation; to exclude, expel or remain indifferent to an annoying object. The accompanying covert behavioural pattern here was to "push away". In these subjects, the outstanding dispositional tendency, assessed on Murray's behaviour variables, was "rejection". They displayed feelings of disgust, scorn, boredom, indifference and attitudes of forbidding, scorn, criticism, discrimination and selection.

In subjects who experienced pain in the Diaphragm and Sterno-costalis, the environmental stress situation was loss of someone dear, or a personal feeling of being rejected and unwanted. Their behavioural tendency towards the stress situation was to crave for affection, tenderness and recognition; to cry, to plead or to ask for love, protection or aid. The accompanying covert behavioural pattern was "to adopt a pathetic and tragic appearance". In these subjects, the outstanding dispositional tendency, assessed on Murray's behaviour variables, was "succorance", (insecurity) and "harmavoidance". They displayed a feeling of insecurity, forsakenness, and despair, and a helpless, dependent and grieving attitude.

PAIN IN BACK.

The muscles involved were:

- (a) Quadratus lumborum whose main action is elevation of the pelvis and trunk side flexion.
- (b) Tensor fasciae latae whose main action is abduction of the thigh and internal rotation of the thigh (from the flexed position).

(c) Psoas and Iliacus whose main action is hip flexion.

(d) Vastus intermedialis whose main action is knee extension.

In subjects who experienced pain in the Quadratus lumborum and Tensor fasciae latae, the environmental stress situation was rejection, belittlement or ridicule. The accompanying covert behavioural pattern was to "shrink", to "curl up". In these subjects the outstanding dispositional tendency, assessed on Murray's behaviour variables, was "inavoidance" (inferiority). They displayed a feeling of inferiority, anxiety, embarrassment, shame and mortification and a sensitive, shy, embarrassed, self-conscious and shrinking attitude.

In subjects who experienced pain in the Psoas, Iliacus and Vastus intermedialis, the environmental stress was opposition. Their behavioural tendency towards the stress situation was to overcome opposition by force, to fight or to attack. The accompanying covert behavioural pattern was to "kick". In these subjects, the outstanding dispositional tendency, assessed on Murray's behaviour variables, was "aggression" and "dominance". They displayed a feeling of irritation, anger, rage (temper tantrum)

revenge and jealousy, and a combative, quarrelsome domineering and despotic attitude.

PAIN IN GLUTEAL REGION AND THIGH (SCIATICA)

The muscles involved were Biceps femoris, Semi-tendinosus and Semimembranosus whose main action is knee flexion, and Soleus whose main action is ankle plantar flexion (when the knee is flexed).

In subjects who experienced pain in these muscles the environmental stress situation was censure and retribution from society. Their behavioural tendency towards the stress situation was to avoid blame or rejection, to be inoffensive or to be concerned about public opinion. The accompanying covert behavioural pattern was "to withdraw, to escape or to run away". In these subjects the outstanding dispositional tendency, assessed on Murray's behaviour variables, was "blamavoidance". They displayed feelings of anxiety, apprehension, guilt and remorse and a fearful, scrupulous, conscientious, apologetic and remorseful attitude.

STIMULI AND COVERT BEHAVIOUR

It is widely accepted that overt behaviour can be

elicited by many stimuli. The same rule also applies to covert behaviour.

The present investigation revealed that the stimuli for evoking covert behaviour are manifold and that when pain is once initiated various factors operate in sustaining the covert behaviour, in this way reinforcing the existing pain experience.

It seems logical to assume that when once distressing environmental stimuli are removed, the existing covert behaviour should stop and pain cease. But this does not seem to be the fact. A very minor injury, which may have healed completely in the meantime, may produce pain fluctuations for many weeks, if not months afterwards, or an external environmental stress situation which ceased to exist, or from which the individual has been withdrawn, may still evoke pain of fluctuating severity.

In the past there has been a tendency to regard emotions as a cause of behaviour (especially pathological behaviour). This appears to be a confusion of the symptoms with the cause. It is probably more accurate to say that emotion is a state of tension or readiness to act. This tension represents the reaction of the

organism to the perception of the possibility of need satisfaction, (self enhancement) or the perception of threat, (maintenance of self). And what we describe as the individual's emotion is actually an account of the individual's personal relation to a life situation.

Pavlov (1941) necessarily thought in terms of sensori-motor conditioning; and Hull (1952) says that all behaviour is determined by sensory stimulation.

An S - R connection is strengthened whenever an external stimulus, S, and the response, R, occur together and some need stimulation, N, decreases at the same time. Such a formulation, however, is unable to explain the complicated behaviour of human beings. Therefore, Hebb (1949) proposed to postulate "central receptors" in addition to peripheral ones as motivating agents. In other words, behaviour could also be evoked by stimulation which comes from inside the organism. The internal stimuli are mostly chemical, (hormonal, metabolic or fatigue products). On the human level, however, language and post-language symbols, (thought) provide another form of central stimulation, which allows man to become a "self-conditioning" being, a fact for which the existing doctrines of the "conditioned response", failed to account (Morris, 1950).

This self-conditioning then would account for the fluctuation of pain in the absence of any peripheral stimulation.

In the present sample, a sudden increase of pain due to environmental factors, (peripheral stimulation) was observed in 47 cases, and a sudden decrease, due to similar factors, in 44 cases. Sudden increase due to central stimulation was, however, observed on 52 occasions as being due to physical exertion (fatigue), which is in itself a producer of tension and affects any subject in any disease without exception; on 8 occasions as being due to other physical factors (organic disease) and on 103 occasions as being due to distressing feelings, anticipations and negative attitudes.

A sudden decrease of pain due to central stimulation was observed in 46 occasions as being due to physical rest (restoration of physiological equilibrium); due to other physical factors, (restoration of health) on 5 occasions; and due to joyful feelings, achievements and positive attitudes on 97 occasions. These figures show^w an overwhelming preponderance of pain caused by central stimulation.

This concept of pain stimulation obtains still further confirmation when account is taken of the minor fluctuations which have been recorded in Section VI p.88,89 (Results) as "Pain usually worse" or "pain usually eased". Pain appeared to be usually worse at the end of a strenuous working day. Here, undoubtedly, chemical factors in the form of accumulation of waste products and lack of replenishment of energy operated; such pain causation is quite understandable and acceptable. But why muscular pain should usually become worse during the night or during weekends and holidays, when the body is "at rest", is rather puzzling. In the sample, pain "usually worse" during night was noted in 101 subjects. When, however, the pertinent symptoms present, during this fluctuation of pain were considered, 91 subjects out of 101 ($p = .90$) had sleep disturbances and 60 subjects out of 101 ($p = .59$) had headaches. In 49 subjects it was observed that the pain was usually worse during weekends and holidays. Here the pertinent symptoms present were depression and boredom in 35 subjects ($p = .71$) and headaches in 41 subjects ($p = .83$). These symptoms: sleep disturbances, headaches, depression and boredom constitute vivid evidence that these subjects, during their resting period, were occupied in thinking towards

processes, language and non language symbols (thinking) a solution to their "problems". This kind of behaviour is, in the older clinical literature, usually termed "worry".

These latter subjects when treated in addition with sedatives, showed quickened recovery. A similar observation was made by Rangel (1953).

Minor fluctuations of pain in the direction of "decrease", were observed in 38 subjects when keeping off strenuous work. Here, clearly, chemical factors operated (restoration of physiological equilibrium). In 37 subjects, a decrease in pain was noted while they were occupied. Their "thinking", at that time, seemed to be directed to other problems than to the distress causing problem. In 100 subjects, pain decreased after they had "moved about". In these latter observations, the easing of pain was most likely due to disruption, (through movement of the behavioural pattern, (muscular contraction) which took place in the so called motor units of a muscle or muscle group, and also probably to restored normal blood supply, assisted by reciprocal contraction and relaxation of the involved muscles.

It has to be stressed, however, that our symbolic

processes, language and post language symbols, (thinking) are significant to the individual only in terms of personal experiences in relation to his environment. According to Masserman, (1946) symbols do not have a transcendent quasi-Platonic existence per se, but are meaningful only in terms of individual experiences and interpretations of the behavior. Furthermore, these symbol-meanings are continuously being both expressed and modified by the individual's current motivations, attitudes and environmental adaptations.

Therefore, no single instance in this study was observed in which "thinking" per se, isolated from the environment, was responsible for any pain occurrence or fluctuation. It must also be said that it always seemed to be the present environmental (internal or external) stress situation which was responsible for disruption of the subject's normal behaviour, and for causing the individual to make attempts at readjustment and not a genetic bias as proposed by Freud, (1949). In all fairness it has to be added, however, that an individual could have acquired in the far past, a specific pattern of behaviour which became part of his personality and with which he responded to similar situations on later

occasions, (transfer of learning). This was demonstrated most strikingly in cases which had repeated muscular pains in the past in the same muscular structures, when confronted with similar environmental problems.

Another operating factor promoting motivation which can bring about localized tension of muscles must be mentioned. All subjects, without exception, displayed, to a greater or lesser degree, a tendency to avoid pain, and concern over their bodily functions and well being. Such behaviour could be classified as anticipatory reactions to danger signals or as a response to premonitory cues. It is obvious that these danger signals acquired their significance of danger because of previous experience of the individual. A danger signal, according to Davis (1954) activates a secondary drive and thus elicits responses which are directed to the removal of the danger, but which fail. The secondary drive, therefore, remains active and strong.

Mowrer (1950) calls this form of behaviour, "anxiety", which is, according to him, an instance of secondary motivation, which shows its double status as both a product and producer in acquiring new patterns of behaviour.

Anxiety as an instance of secondary motivation has two outstanding characteristics:

(a) it creates or, perhaps more accurately, consists of a state of heightened tension (or attention) and a more or less specific readiness for the impending traumatic stimulus and

(b) by virtue of the fact that such a state of tension is in itself a form of discomfort, it motivates the organism to escape from the danger situation. But because the discomfort (pain) is found within the subject himself, it is impossible to escape from it and, therefore, instead of a decrease of pain by "flight" from the traumatic stimulation, tension or "avoiding-pain" behaviour increases, which in turn results in greater pain.

All subjects in the present sample showed varying degrees of anxiety and pain avoidance. The degree of anxiety varied considerably; a higher degree of anxiety was displayed by subjects in whom the pain appeared suddenly without warning; subjects with more chronic muscular pain showed less anxiety. This anxiety disappeared almost completely when the pain experience was stopped either through the application of physical means, salicylates or sedatives. The other characteristic

feature of anxiety was found to be the subject's own correlation of pain with some imagined serious disease of an organ or some other part of his body, (exaggerated concern over bodily function and well being).

If the pain appeared to be in the arm or leg, a nerve was usually blamed for the causation of pain, and as a rule, the "worry" and "anxiety" of the subject in such a case was not excessive. Should the pain, however, be in the back or chest wall, many "causes" by the subject were brought forward, e.g. "Oh, it must be my spine", "Maybe it is tuberculosis", "Oh, it must be something wrong with my bowels or lungs". The most distressing anxiety - evoking thought, however, was the possibility of having cancer. (In the past, tuberculosis seemed to be the most feared disease). In these cases reassurance by demonstration, i.e. by the experimental removal of pain by passive relaxation and not by taking a pill or by getting an injection, proved to the subject that the pain was only muscular and this served as a useful agent in removing "anxiety" and promoting cure.

Summing up on the question of covert behaviour as the causative factor in producing muscular contraction, the

investigation revealed that covert behaviour was evoked by:

(a) Distressing external environmental stimuli, usually a problem situation of long duration (an unusual task), - one that called forth activity in which the subjects were not allowed to express themselves freely and therefore took up a "postural attitude" towards it.

(b) Stress situations arising in the internal environment, e.g. from a diseased organ or other painful structure in their body. In such instances, the covert behaviour took the form of "protection" of the painful part, "avoidance" of pain or "withdrawal" from a traumatic situation. These were forms of direct or peripheral stimulation.

It was found that covert behaviour could also be elicited by central stimulation, namely by "self-conditioning" and "secondary motivation". Human beings, with their language and post-language symbols (thought), are able to carry environments from place to place with them and react towards these transferred environments as to a real environment. By "secondary motivation" is meant a response to danger signals or premonitory cues

(anticipation of danger), which is generally called anxiety. This anxiety, it was found, depended entirely on the experience of the individual. The more familiar an individual became with a particular situation, the less anxiety he experienced, and at the same time his covert behaviour diminished as well.

Finally there were chemical factors operating in the form of accumulation of waste products as a result of fatigue. The findings of this investigation suggest, however, that these chemical factors reinforced muscular tension already present, rather than being in themselves an initiating factor in evoking covert behaviour.

MUSCULAR PAIN AS A SENSATION

There are at present, four theories of pain:

(1) The older emotion theory, which supposes pain to be a phase of unpleasantness, an emotional state excited by some sensation.

(2) The theory that pain is a sensation with its own distinct central and peripheral sensory mechanism.

(3) The intensive theory, based on the concept that pain is the result of over stimulation of receptors, for

heat, cold, pressure and intense smooth muscle contraction.

(4) The combined theory, which holds that pain experienced is composed not only of pain sensation but of associated sensations and emotional and affective states as well.

All these theories apply mostly to cutaneous pain experience. The theory that pain is a sensation with its own peripheral and central neural mechanism is the most favoured one.

When considering deep (somatic) pain, the picture is not so clear. The questions which have to be answered are: Under what conditions does a muscle, normally insensitive to cutting, piercing with needles or even burning, become pain sensitive? What is the underlying neuro-physiological mechanism? and What is the "true" stimulus to muscular pain?

The conditions under which a muscle becomes pain sensitive are undoubtedly excessive contraction of the whole muscle as occurs in cramp, or excessive contraction of a part of a muscle, (probably confined to a few motor units), as it appears to happen in "clinical" muscular pain.

The experimental removal of pain, by means of passive relaxation, and reinduction of pain by forcing the muscle back into contraction demonstrate that somatic pain is due to excessive muscular contraction. In addition to this, the possibility of inducing pain in a sound muscle and comparing such experimentally induced pain with previous pain experience e.g. fibrositis, muscular rheumatism, etc., was investigated. For this purpose, use was made of a quadriceps bench. The subject assumed a sitting position, supporting himself with his hands at his sides, with a strap fixed round his ankle. This strap was connected to a rope which ran over three pulleys. At the far end of the rope was suspended a weight.

Ten subjects were used in this experiment. The subjects were: two physicians, five physiotherapists and three nurses, all of whom had in the past had muscular pain, (described as fibrositis, etc.).

The muscle on which the experiment was carried out was the Quadriceps. The subjects were asked to extend their knees and, depending on the strength of the Quadriceps, an appropriate weight was suspended on the

far end of the rope. The subjects were then instructed to hold their knees extended for as long as they could, and report, in the meantime, what they felt. After 30 to 80 seconds aching pain began. Afterwards, between 55 and 105 seconds in addition to aching pain, fibrillation followed and finally, between 70 and 300 seconds, the pain became cramp-like and fibrillation of the Quadriceps changed to convulsions. At this point the subjects could no longer keep their knees extended and dropped their legs. Immediately afterwards, the aching pain changed to glowing warmth, (probably due to renewed blood supply). When asked to compare this experimentally induced pain with previous "fibrositic" pain, all subjects answered that it was the same - a dull aching pain. This, then, would support the proposition that a muscle becomes pain sensitive when excessively contracted.

Before an answer to the question concerning the underlying neuro-physiological mechanism and "true" stimulus can be given, it is necessary first to discuss the quality of pain.

In the clinical literature, a dozen or so categories are used to describe pain quality, e.g. aching, burning,

pricking, gnawing, stabbing, throbbing, shooting, gripping, nagging, etc. None of these descriptions, except the first three, (aching, burning and pricking) conveys any real description of pain quality. They refer rather, to the way in which the pain occurs.

The pricking quality of pain seems to belong entirely to cutaneous pain sensation. It is recognised that the receptors for this sensation are the free nerve endings and that this kind of pain is accurately localized by the person concerned. Any other quality of pain, even if it appears to be experienced in the skin, undoubtedly has a connection with either smooth or somatic muscles.

Pain from muscles is diffuse and difficult to localize by the individual experiencing the pain. (Lewis, 1938). It was found in this investigation that in the clinical variety of muscular pain, aching was the predominant quality, and this could vary from a sharp ache, appearing in spasms, to a dull ache, lasting for hours. Cyriax (1947) suggests that the quality of muscular pain can also be "burning".

There is sufficient evidence to assume that aching pain is evoked by excessive and long-standing muscular

contraction. Mild heat, in this case, eases the pain. The burning variety of pain, on the other hand, appears mostly in connection with inflammation. In such instances the application of cold eases the pain.

In searching for any instances in which the burning pain is experienced spontaneously without any "apparent reason", as happens in the aching variety, such pain was found only in one instance, and that was in cases of a drop of the transverse arch of the foot or after Keller's operations. No such pain was ever observed in the dropping of a longitudinal arch of the foot. The reason appears to be, that the principal function of muscles is to contract. As the intrinsic muscles of the longitudinal arch are used actively to flex the toes, in case of dropping of the arch, they contract, preventing further lowering of the arch and therefore aching pain is experienced. The muscles which support the transverse arch are rarely used actively, and therefore in the case of the dropping of this arch, they are stretched passively. It must also be added that passive stretching of somatic muscles, in a healthy individual, is as a rule prevented by ligaments, bony projections and the meeting of two parts of soft tissue bulk.

Therefore, in order to obtain some information as to the quality of pain when a muscle is stretched, it was necessary to turn to subjects who had some muscle groups shortened due to long immobilisation after accidents or to neuro-muscular lesions.

Ten subjects with shortened adductors of the shoulder were investigated. The subjects were first assured that they would not be hurt, and were asked to allow the investigator to stretch their shortened muscles passively. When passive stretching took place they were asked to report their sensation in these stretched structures. The report was, in nine cases, a burning sensation; in one it was aching. This latter subject, however, would not allow the investigator to stretch his muscles passively; he counteracted by contracting the muscles in question. These nine subjects, after they had experienced burning pain, were asked to contract their passively stretched muscles, and after a while the sensation changed from "burning" to "aching".

This, then, seems to indicate that excessive contraction of a muscle causes aching pain, and excessive stretching, burning pain.

When considering in which part of the muscle the aching pain and in which, the burning pain is experienced, we find overwhelming evidence that the aching variety is experienced most profoundly in the so-called trigger spots, myositic spots or myalgic spots, (these should not be confused with fibrositic nodules, which are pain insensitive, - Cyriax, 1947).

The burning variety appears to be experienced in the muscle belly itself.

The localization of myalgic spots, in subjects suffering pain in similar muscular structures, displays a uniform picture from subject to subject. These myalgic spots are found at the junction of the tendinous and fleshy part of a muscle. They correspond closely, according to Good (1943) to the origin and insertion of a muscle. Pressure on a myalgic spot elicits severe and agonising pain. Fletcher. (1947) described muscular pain, (fibrositis) as being characterised by muscular tenderness and spasm, but the typical picture, according to him, is that the pain can be found to originate in certain localized "trigger points".

From the evidence obtained as to when a muscle becomes

painful (contraction or stretching), the quality of the pain experienced (aching or burning), and its pain localization (at the junction of tendinous and fleshy part of a muscle or in the belly of a muscle itself), inferences can be made as to the underlying neuro-physiological mechanism involved.

The fundamental questions here are: What are the pain receptors? Are they the free nerve endings generally recognised as pain receptors or is there some other mechanism operating?

It is an established fact that the free nerve endings are the receptors for cutaneous pain. The supposition is made by many authors that free nerve endings may be expected to be found also in muscles. Histological examinations, however, have not confirmed such suppositions. Free nerve endings, on the other hand, have been found in the blood vessels that serve the muscles; but the evidence as to how many there are and where they actually end is conflicting, (Morgan et al, 1950). It must also be remembered that neither biopsy nor necropsy have been able to produce any demonstrable pathology of acute muscular pain, (Gordon, 1941).

There is substantial evidence to show that a muscle is fairly, if not completely, insensitive to "normal" pain stimulation, but becomes pain sensitive when exaggerated contraction or stretching takes place. Because of this, the possibility must be considered that in these instances, the receptors for "feeling of motion" - in other words, the kinesthetic receptors, play a double role.

This concept is by no means a new one. It was first mentioned by Gowers (1904) who attributed the pain of fibrositis to the sensory function of the muscle spindles. This idea, that muscle spindles could be possible muscular pain receptors has been mentioned twice in more recent years, but without any more detailed elaboration. (Buckley, 1940 and Tarsy, 1953).

It would seem that in the case of the aching quality of pain which is evoked by extreme muscular contraction, the Golgi tendon organs, being overstimulated, become the aching pain receptors. This, then, would explain the existence of so called "trigger points" or "myalgic spots" from which pain seems to originate and which are found to be localized exactly in the same part of a muscle as the

Golgi tendon organs.

These myalgic spots were found to be present only in an aching muscle and disappeared with improvement, as this investigation has shown.

In the case of the burning quality of pain, which is evoked by extreme muscle stretching, the muscle spindles, being over stimulated, appear to become the burning pain receptors.

That in the burning quality of pain, when the muscle is stretched, the muscle spindles and no other mechanism is involved, can also be inferred from an experiment carried out by McArthur et al. (1953) on counter irritants in deep and superficial pain. They injected 2 cc of 2.75% saline into the Brachio-radialis. This, according to McArthur, produced aching pain. Then counter irritants by means of radiant heat, galvanic stimulation or chemical irritants strong enough to produce severe pain, were applied to the skin. Under these conditions relief of deep seated pain was obtained. They concluded that counter-irritation depends on the product of skin pain of adequate intensity, and that cutaneous vaso-dilation was unimportant.

This experiment was repeated with eight subjects,

(physiotherapists and nurses) in exactly the same setting.

Care was taken that these subjects were at ease during the experiment. The subjects reported not an aching but a burning pain at the beginning, which slowly changed to mild aching which finally disappeared. Instead of the application of counter irritants, the subjects were asked to tense up the flexors of the elbow (in which the Brachio-radialis was included). The result was that the burning pain stopped in 3-5 seconds. When tension was released the burning sensation recurred.

What is the possible explanation of this experiment in the light of behaviour theory?

By injecting a hypertonic saline solution into the muscle, or more exactly into the intracellular spaces and capillaries, a localized osmotic water attraction takes place, (Evans, 1947), during which the plain muscles of the blood vessels are being passively stretched to such a degree that burning pain is felt. Through applying painful counter-irritants a protective behavioural pattern is evoked, which calls forth tension in the muscles. In the present experiment, this tension was produced voluntarily. The muscular tension produced seemed to diminish

the osmotic pressure by preventing the blood vessels from being excessively filled up and their plain muscles unduly stretched. In this way, relief of deep pain could be obtained.

Another example of muscle spindle involvement in burning pain can be observed in Causalgia, in which the median or sciatic nerve is partially injured. Within a few days, burning pain develops either in the hand or in the foot. After the malady has continued, the skin of the tender parts assumes a deeper blood colouration and the hand or foot feels "tight". The explanation of this appears to be that sympathetic nerves run in common sheaths with somatic nerves and in the case of a nerve injury, both nerves are affected. Thus the plain muscles in the blood vessels are deprived of a vaso-constrictor, and as a result the blood vessels are filled excessively and the plain muscles stretched to such a degree that a burning pain sensation is evoked.

That the burning pain in Causalgia is due to excessive muscle stretching in blood vessels and nothing else can easily be demonstrated experimentally. In such cases, when the affected hand or leg is raised so that

the blood drains away, or when the hand or leg is immersed in very cold water by which the tissue is contracted and the overfilling of blood vessels is prevented the existing experience of burning pain ceases.

Thus there seems sufficient evidence to assume that overstimulation of stretch receptors, (muscle spindles) and tension receptors (Golgi tendon organs) results in pain experience. Such a formulation of somatic pain receptors would support the intensive theory of pain but with some modification i.e. that it applies only to overstimulation of the two muscle kinesthetic receptors, and not, as thought by Nafe (1934) that pain sensation was due to overstimulation of the receptors for heat, cold and pressure, (which are cutaneous receptors).

It is now possible to answer the crucial question: What is the "true" stimulus to muscular pain? The answer appears to be excessive contraction or excessive stretching of a muscle itself. Contraction of a muscle, as it happens in "clinical pains" can be brought about by many factors. The basic factor, however, was shown to be covert behaviour. Accumulation of fatigue products, painful skin stimulation, either by excessive heat or cold,

and other forms of chemical stimulation were found to be additional factors in this respect.

There are, however, other views on this matter.

Elliot (1944) postulated an idea that localized areas of increased tone in the gluteal and leg muscles (sciatica) were due to lesions elsewhere, probably due to pressure from a protruding disc on a sciatic nerve root. For some time, Elliot's idea became the "vogue" for the diagnosis and treatment not only of the condition described as sciatica, but of any other muscular pains.

That slipped discs may occur and that they may result in localized pain (with some spread of pain) is indisputable; what should however be considered is the discrimination of symptoms present in a nerve trunk or nerve root involvement and pure muscular pain.

Nerve sheath is very sensitive to pain stimulation, and nerve fibres themselves as they pass the point of injury, may be the source of stimulation. When this occurs, skin pain felt in the cutaneous territory of the nerve is added to the deep pain and there will be disturbances of touch and other sensations, usually described as tingling, "pins and needles", numbness, feeling of hot

and cold, etc. It must also be remembered that only borderline degrees of injury produce increased excitability of nerve fibres. Increasing injury, on the other hand, rapidly induces paralysis and paraesthesia.

In addition, not only a slipped disc can produce typical symptoms of nerve involvement but pressure anywhere along the nerve trunk. In the present sample there was one subject in whom such pain and "pins and needles" sensation in his hand were due to pressure on the median nerve caused by contraction of the Pronator teres. (The median nerve runs between the superficial and deep head of this muscle). Only when his arm was semi-flexed and pronated (overtly or covertly) were these symptoms present. There were also three subjects diagnosed as suffering from sciatica (query disc lesion) who, in addition to pain, experienced the sensation of "pins and needles". In one subject, this sensation appeared to be due to pressure on the sciatic nerve caused by contraction of the Biceps femoris, (the sciatic nerve runs under this muscle) and in two subjects, due to pressure on the posterior tibial nerve caused by contraction of the Soleus. (The posterior tibial nerve is covered by this muscle). Whenever these muscles

were relaxed, the symptoms of nerve involvement disappeared. Nerve involvement symptoms can also be demonstrated experimentally by exerting pressure on any part of any nerve. For instance, pressure with the fingers on the median nerve, just above the anti-cubital fossa, will produce the same symptoms.

Cyriax (1947) and Copeman (1948) both state that nerve or posterior root involvement in muscular pain should be taken with the greatest caution, because the symptoms of nerve involvement differ greatly from the symptoms present in muscular pain.

Kersley (1950) gave an example of an analysis of 273 cases of sciatica. In 45% the pain had a myofascial origin, in 25% there was an hysterical element, and in only 15% out of 103 cases was laminectomy considered advisable, and this resulted in 11 cures although in only 9 of these was a protruding disc discerned.

All this, then, points to the fact that in aching muscular pain it is necessary to look for other reasons causing the localized muscular spasm, than to attribute it to disarrangements in the spinal column only.

Muscle contraction is an active affair. Muscle stretching, however, is a passive affair and appears to occur in somatic muscles only in cases of pathological locomotor derangements or through an outside agent and is therefore rarely experienced.

The postulation of kinesthetic receptors as pain receptors when overstimulated, would indicate that cutaneous pain receptors differ functionally from muscle pain receptors, and it seems to be unsafe to class both together under the single term - "pain" receptors. Cutaneous pain receptors are sensitive to any direct stimulation (e.g. pricking, scratching, cutting); deep pain receptors in the muscles, however, function only through the medium of over contraction or over stretching of muscles. This, then, would seem to explain why, in the absence of any tissue pathology, a muscle may become the source of pain, and why such an enormous variety of stimuli (chemical, thermal, mechanical, behavioural), can evoke the same sensation.

COLD, HEAT AND PAIN

It is a commonly accepted fact that cold increases

referred pain. Gallwey (1934) established the idea that pain and that mild heat eases pain (Stone, 1947). However, that extreme cold or heat may produce pain by itself, can be most easily demonstrated by applying to a part of the body, e.g. the hand, temperatures around or below freezing point, or high temperatures from 52°C upwards.

What is most often discussed in clinical literature is, however, the empirical observation that cold may increase already existing muscular pain, or re-evoke pain in muscles in which the pain has ceased temporarily. This phenomenon seems to be due to the fact that with lowering of temperature all matter contracts; by so doing, the already ^{partially} tensed-up muscles contract further, and as a result the pain is re-started by exceeding the threshold of pain sensitivity, or the existing pain is increased.

Mild heat on the other hand produces slight extension of all matter. In the case of muscles, this slight extension results in the lengthening of the muscle fibres, in other words promotes relaxation, and therefore the pain is eased. Such a phenomenon is an accepted common-sense principle employed in physiotherapy.

REFERRED PAIN

Diffused or pain that has spread is commonly called

referred pain. Kellegren (1938) postulated the idea that pain radiates segmentally due to the convergence of pain pathways from the surface (dermatomes) and the interior (myotomes). This convergence, according to him, takes place at the spinal level, since deep pains are referred to the skin of the corresponding spinal segment.

Considerable discrepancies between innervation of dermatomes and myotomes were demonstrated by Inman et al. (1944) and this seems to throw doubt on the general rule of the segmental spread of pain. (Ogilvie, 1950).

In the present sample, the spread of pain from one area to another showed a definite relationship with changes in the external or internal environmental situation and the subject's reaction towards it.

When the subject was confronted with a new stress situation, during the time he had muscular pain, additional muscles became involved. This additional muscle involvement depended on the subject's overt or covert reactions towards the distressing problem. In all cases of pain experience, there was the tendency to "protect", or to "avoid" pain. This in turn brought additional muscles into contraction, which resulted in a spread of pain - so called referred pain.

MUSCULAR PAIN AND AGE

It is remarkable that children do not seem to suffer from muscular pains in the same way as adults do.

The youngest subject in the sample investigated was 16 years of age. She experienced pain in her Rectus abdominis, following appendicectomy (physical facilitation of pain). The youngest subject in whom muscular pain was due to psychological facilitation was 18 years of age.

Footnote:

There is, however, in children the well known "growing pains" phenomenon, which has an incidence in the school children population of about 4.2 per cent. Apley et al. (1955) on the basis of a physical investigation suggested that the name of this malady, "growing pains" should be abandoned and that the malady be included in the "psychogenic rheumatism" group.

Because of the limitation of these pains to limbs and especially to lower limbs, and also because of the limitation of the maximum incidence of occurrence to a particular age group, (between eight and twelve years of age, Apley et al, 1955) it would appear, that before the so called "growing pains" can be regarded as being of "psychogenic" origin, a closer behavioural investigation is needed.

Empirical evidence would seem to indicate that in adults the after effects of an injury usually result in some pain experience, due to the "protective" pattern of behaviour. In children, on the other hand, these after-effects result in locomotor disorders, e.g. limping, holding a limb stiff etc., which are due rather to the "avoidance" pattern of behaviour.

Such differential behaviour could be explained on the assumption that children use different adjustive techniques (Cameron, 1947). They do not differentiate fully between "cause and effect" and therefore more readily retain their behavioural pattern which was appropriate during the actual time of injury. There is also the probability that children have not yet fully learned to respond to "danger signals", and therefore the "protective" behaviour pattern with its consequential tension formation is absent in them.

And again, that children do not develop muscular pains brought about by covert behaviour as a response to a stress situation in the external environment, appears to be due to the use by children of different mechanisms of tension release. Their tensions are greatly released

through crying and free expression e.g. hitting, shouting, kicking, temper tantrums, being naughty, etc., a form of behaviour which is to a certain degree accepted in our social setting. After all, children's general attitude to life differs from that of adults. Children are more submissive and dependent; adults, more individualistic and independent; therefore, when adults are confronted with a stress situation, they try to do something about it. Children on the other hand, being cared for, expect their parents to solve a problem for them, in this way avoiding "bottling up" of their tensions.

MUSCULAR PAIN AND THE AUTONOMIC NERVOUS SYSTEM

The idea that skeletal muscles may receive a nerve supply from the vegetative as well as the somatic division of the nervous system, may be said to date from a very remarkable observation made by Vulpian in 1863. If the motor nerve to the tongue (the hypoglossal) is cut and allowed to degenerate, subsequent stimulation of parasympathetic fibres to the organ (fibres of the chorda tympani) will throw its muscles into contraction. This observation, however, applies to the parasympathetic and not to the sympathetic system (Stone, 1947).

The possibility of sympathetic innervation of the somatic muscles was investigated by many anatomists, physiologists, histologists and clinicians. The evidence presented by them appears to be conflicting. There is, however, a growing tendency to accept the idea that sympathetic innervation is probably confined only to blood vessels supplying the muscles, and not to the muscles themselves (Mitchell, 1953).

Of considerable interest is Orbeli's demonstration quoted by Wright (1952), that sympathetic stimulation antagonises the onset of fatigue in skeletal muscles. Orbeli produced an isometric contraction of a frog's muscle by stimulation of the motor nerve repeated at short intervals. Fatigue set in, as shown by diminution of the height of contraction. The sympathetic supply of the muscle was now stimulated while the motor stimulation was still continued. After a considerable latent period the size of the contractions became greater, and this effect persisted for some time after sympathetic stimulation was discontinued. Stimulation of the sympathetic alone, produced no recognizable effects on resting muscle. The conclusion drawn from this experiment could be that there was no direct innervation of the somatic muscles by the

sympathetic nervous system, and that the influence of the sympathetic system on somatic muscles was probably transmitted through chemical factors. Adrenalin, which is a sympathetic transmitter, produces similar effects.

The present investigation revealed a close relationship ($C = 0.776$) between activities sponsored by the autonomic nervous system and muscular pain. Furthermore, another characteristic feature of muscular pain was recorded namely, that no subject, whenever the pain was severe, was able to relax actively - even if he had mastered the technique of relaxation perfectly.

It does not seem likely that these findings can be explained by the idea of "double" somatic and autonomic muscle innervation alone.

It is a well known fact that autonomic irradiation is a pronounced phenomenon. Lacey et al (1953) set up an experiment in which "stress" was imposed experimentally. They found that the autonomic nervous system responds to experimentally imposed stress "as a whole", in the sense that all autonomically innervated structures seem to be activated usually in the direction of apparent sympathetic predominance. This response, however, is individually

determined. Lacey's experiment has further shown that for a given set of autonomic functions, individuals tend to respond with a pattern of autonomic activation, in which maximum activation will be shown by the same physiological function, whatever the stress.

Thus, the explanation of the close relationship between autonomic activation and muscular pain, as revealed in the present investigation could be, that when an individual is exposed to a stress, his predominant response towards it is autonomic. This does not mean necessarily that there is a double innervation of somatic muscles.

The other finding, that during severe pain (not cramp) subjects in this study were unable to relax actively (their muscles remaining in a continuous slightly shortened state), again does not seem to be due to the action of the autonomic nervous system. It is rather due to fatigue. If a muscle is repeatedly stimulated, changes soon become apparent in the curve of contraction; the latent period is prolonged, and the absolute height and work done are diminished. At the same time the muscle does not return to its original length. The shortening which remains is spoken of as "contraction remainder" (Evans, 1947).

This phenomenon of "contraction remainder", caused by fatigue of the muscles, would most probably explain why active relaxation was impossible in time of increased pain, when greater contraction of muscles prevailed.

From physiological findings, it is known, that if a muscle which has been exhausted by repeated stimulation is left to itself, it will partially recover. The recovery is hastened by passing a stream of blood or even of salt solution, through the blood vessels of the muscle. It would seem evident then, that by using the passive technique of relaxation, the operator, by moving the muscles passively to and fro, helps the circulation, which in turn hastens the return of the muscle to its original length.

In a similar way by "contraction remainder" and by increased blood supply through movement, an explanation can be formed for the observation that subjects with slight muscular pain usually felt stiff in the morning, but after "moving about", the pain vanished. This fact was noted in the sample in 101 subjects out of 112 ($p = 0.9$).

ASSESSMENT OF CURE AS A TEST OF THE HYPOTHESIS

The present investigation on muscular pains was based on two groups: one experimental and one control.

It has been assumed in the postulated hypothesis that muscular pain is caused by muscular contraction as an implicit sustained response, under stress, to a noxious environment (internal or external). Thus, since some muscular pains were assumed to be due to psychological facilitation, the experimental group, in addition to their normal physical treatment (directed mostly to the effect), received further treatment (desensitization) directed to the cause with the intention:

(a) of disrupting such acquired motor behavioural patterns by first passive, then active relaxation;

(b) of reassuring the subject that the pain is only muscular and that there was no immediate danger, (supportive therapy);

(c) of giving insight into the causes of excessive muscular contraction and so promoting self-adjustment to changed internal or external environmental situations (self-directive therapy).

The matched control group received physical treatment only. Table XIX Results (Page.118.) indicates the marked differences in recovery that existed between the control and experimental groups.

The eight subjects, in the experimental group in whom there was no improvement, were found to be confronted with very serious stress situations (e.g. divorce, illness of husband, etc.) still operating, and there was no possibility of self-adjustment to these new environmental conditions, unless the environment itself could be "manipulated" for them.

In this experimental setting, the null hypothesis was tested, i.e. that there is no significant difference, (except due to chance of sampling), in the degree of recovery between these two groups. The statistical method employed to test the null hypothesis was the Chi square technique and the obtained result was $X^2 = 17.44$, $df = 4$; $P < 0.01$; or $.005 < P < .002$. (Results, Page.118.).

From these figures it can be concluded that beyond all reasonable doubt there is a significant difference in the degree of recovery between these two groups, and as a result, the null hypothesis is disproved and must be

rejected.

The additional measures applied in assessing the difference in recovery between these two groups show that in the experimental group, the "cures" were obtained in a much shorter time and from fewer attendances for treatment.

The spread of time in which recovery took place in the experimental group, was from 1 to 90 days with a Mean = 25.0 days, and in the control group from 1 to 150 days with a Mean = 59.5 (σ Diff = 3.76; C.R. = 8.96). The number of attendances for treatment in the experimental group was from 1 to 30, Mean = 8.96 attendances; and in the control group from 1 to 50, with a Mean = 18 attendances (σ Diff = 1.03, C.R. = 10.64).

The high critical ratio obtained in both measurements, indicates that the difference in time in which recovery took place, and the difference in the number of attendances for treatment in these two groups, is a true one and is highly significant. Thus the data obtained with regard to "end results", indirectly confirm the basic proposition that muscular pains, in their clinical entity, are greatly facilitated by psychological factors. It should not be taken for granted, however, that only psychological factors

are involved in muscular pain causation. It would be fair to say that the present investigation has shown that there is never one factor operating in muscular pain causation. The factors are numerous and stretch from physical to psychological facilitation and from psychological to physical facilitation. All these factors operate on one dimension.

A purely physical injury may evoke many behavioural patterns, which, in themselves, may become the source of discomfort or pain. On the other hand, a purely behaviourally-caused muscular pain, if it lasts long enough, may bring about physical changes in the muscles. Thus it can be said that a physical "case" may in time turn into a psychological one, and a psychological "case" into a physical one. For these reasons, Graham (1954) proposed that the most effective approach in treatment of muscular pain would be a double one - by psychotherapy and physiotherapy.

SECTION VIII

SUMMARY OF THE CONCLUSIONS REACHED

1. Because of the relative absence of tissue pathology in muscular pains, described clinically as fibrositis, muscular rheumatism, etc., the possibility that these pains constitute a behaviour disorder was investigated.

2. It was found that these muscular pains were due to muscular contraction (muscular tension). By relaxing the muscle in question passively, pain could be removed experimentally and by forcing the muscle back into contraction through modified resisted movements, pain could be re-induced experimentally.

3. It was observed that these muscular contractions were brought about by covert behaviour as a response to a stress situation. In the case of an existing stress situation in the internal environment, (organic disease or locomotor disorder), the covert

behavioural pattern tended towards "protecting" the affected part of the body, towards "withdrawing" from a painful stimulation or towards "avoiding" pain. In the case of an existing stress situation (unusual task) in the external environment, the covert behavioural pattern tended to accompany the overt (verbal or motor) behaviour with the assumption of "postural attitudes". Covert behaviour was also found to be frequently a substitute for free expression in our social setting.

4. These forms of covert behaviour were found to be reinforced by "central facilitation", i.e.:

- (a) by self-conditioning evoked through language and post-language symbols, (worry).
- (b) by "secondary motivation", also called "secondary drives", evoked through response to danger signals which in the past, at one time or another, exposed the individual to painful experience, (real or anticipated).
- (c) by accumulation of fatigue products.

5. It was discovered that the pain began at a time of crisis or special stress, (physical or mental),

that its severity fluctuated with the degree of strain, and that it sometimes ceased spontaneously with alteration in the life situation.

6. Detailed examination of the site of muscular pain revealed that pain could be localized in exact muscular structures, which formed well defined functional units. It was also found that the deeper muscular structures, which constitute so called prime movers, were involved foremost. In the case of the burning quality, (when the muscle is stretched), the muscle 7. The relationship between personality make-up, environmental stress and site of pain was examined and a close link between these three was found. Motor behaviour, as expressed by muscular contractions to the degree in which pain was evoked, constituted a site of pain that appeared to be inseparable from the subject's displayed pertinent dispositional tendency and the form of the environmental stress itself.

8. The quality of muscular pains in their clinical entity was found to be aching. Additional

experimental evidence revealed that a burning quality of pain could also be experienced in muscular tissue.

9. Inferences have been made as to the underlying neuro-physiological mechanism involved in muscular pain. It was found that these two thermal factors worked upon the muscular tension according to 10. It is proposed that the receptors to pain in the case of the aching quality, (when the muscle is contracted), are the Golgi tendon organs, and in the case of the burning quality, (when the muscle is stretched), the muscle spindles.

11. In both above mentioned instances, over stimulation of the muscle kinesthetic receptors evoked pain. This, then, would support the "intensive" theory of pain.

12. The "true" stimulus to muscular pains was found to be either the contraction or stretching of a muscle. It was observed that contraction of a muscle could be initiated by covert behaviour, chemical, thermal or mechanical factors. Stretching of a muscle, being a

passive affair, rarely occurred spontaneously. It could be initiated, however, by locomotor derangements and "outside" agents.

13. The relationship between cold, heat and pain was investigated and it was found that these two thermal factors worked upon the muscular tension according to thermo-dynamic laws: under cold all matter contracts, and under heat, extends, thus producing, or reinforcing further contraction, or relaxation of the muscle fibres.

14. The question of referred pain was examined and it was found that the spread of muscular pain extended in relation to:

(a) changes in the external environment (new stress situations), and changes in self-adjustment;

(b) protective behaviour with the intention of "protecting" a painful organ, of "withdrawing" from a painful stimulation or of "avoiding" further pain.

15. The question of age and muscular pain was considered; and it was suggested that the absence of this complaint in childhood and adolescence, was probably due to different prevailing adjustive behavioural patterns and protective mechanisms operating in these age groups.

16. The concept of double muscle innervation both somatic and autonomic, was critically reviewed, and in light of the evidence of the present investigation, there seems to be no ground for assuming that such double innervation exists.

17. The facilitation of onset of muscular pains was found to be either physical or psychological and that in time a physical facilitation could be reinforced by psychological factors and psychological facilitation by physical factors. Thus what was an organic disease could become a functional disorder, or what was a purely functional disorder could become an organic disease.

18. In order to test the hypothesis that

muscular pain constitutes a behaviour disorder, an experimental and a control group were set up. Both groups received similar physical treatment; the experimental group in addition, received further treatment in the form of "desensitization".

19. The comparison of "cure" of these two groups revealed that:

(a) there was a significantly greater recovery in the experimental group;

(b) that the recovery in the experimental group took place in a significantly shorter time and from significantly fewer attendances for treatment.

20. Finally, a practical conclusion was drawn: that the most effective approach in treatment of muscular pains would be a double one - by simple psychotherapy and physiotherapy.

SECTION IX

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PAIN CHART

Name:

Date Degree of pain SECTION X Life Situations and Subjective Feelings

0 1 2

22.7.54. Treatment began.
 23
 24.7.54. Felt depressed. Worried about
 25 finances.
 26.7.54. Could not face father to whom
 27 he owed money.

28.7.54. Probably treatment?
 29

30.7.54. APPENDICES Bank Holiday.
 31 Stayed at home. Felt bored

1 and depressed. "I even did
 2 not go out to have my usual
 3 pint - I just cannot afford
 4 it".

5 Back at work.
 6.8.54. Feels tired.

7 Very cheerful.

8 Met father. Money question
 9 settled.

10 9.8.54.
 11.8.54. 12
 13.8.54.

U.S. Code of working
 max no pain
 1 = mild pain
 2 = severe
 Circled notes
 Full notes

PAIN CHART

Name: _____

Date	Degree of pain			Life Situations and Subjective Feelings
	0	1	2	
22.7.54. 23				Treatment began.
24.7.54. <u>25</u>				Felt depressed. Worried about finances.
26.7.54. 27				Could not face father to whom he owed money.
28.7.54. 29				Probably treatment?
30.7.54. 31				Week-end and Bank Holiday. Stayed at home. Felt bored and depressed. "I even did not go out to have my usual pint - I just cannot afford it".
<u>1</u> 2				Back at work.
3 4.8.54. 5				Feels tired.
6.8.54. 7				Very cheerful.
<u>8</u> 9.8.54. 10				Met father. Money question settled.
11.8.54. 12				
13.8.54.				

N.B. Code of marking:

0 = no pain

1 = marked pain

2 = severe pain

Circled dates - Sundays

Full dates - treatment days

LIST OF MURRAY'S BEHAVIOUR TENDENCIES
ON WHICH THE SUBJECTS WERE ASSESSED

1. Abasement (Submission)

Subject tends to adopt a passive, meek, humble or servile attitude. To submit to coercion and domination without rebellion or complaint.

2. Achievement (Ambition)

Subject tends to make intense, prolonged and repeated efforts to accomplish a high and distant goal. To have the determination to win.

3. Aggression

Subject tends to act and speak in an aggressive, forceful and sometimes threatening or belligerent manner.

4. Acquisition

Subject tends to gain possessions and property, to bargain or gamble, to work for money or goods.

5. Autonomy

Subject tends to do as he pleases regardless of rules or conventions.

6. Blamavoidance

Subject tends to avoid blame or rejection. To be concerned about public opinion, what the neighbours will say.

7. Counteraction

Subject tends to make up for a failure by restriving. To search for obstacles and difficulties to overcome.

Dispositional Tendencies, Contd.

8. Defendance

Subject tends to defend himself physically or verbally against assault, criticism and blame.

9. Dominance

Subject tends to control his human environment. To master, to control, rule, over-ride, dictate terms.

10. Harmavoidance

Subject tends to avoid pain, physical injury, illness and death. To be cautious and hesitant when undertaking something dangerous.

11. ⁿIfavoidance (Inferiority)

Subject tends to avoid humiliation. Tends to quit embarrassing situations or to avoid conditions which may lead to belittlement, scorn or indifference of others. Tends to fear failure.

12. Nurturance (Compassion)

Subject tends to give sympathy and gratify the needs of helpless objects to be moved by distress of others.

13. Rejection

Subject tends to separate himself from undesired objects. To adopt a disdainful, forbidding, superior attitude.

14. Retention

Subject tends to retain possessions of things, to hoard, to be economical and miserly.

15. Sex

Subject tends to form and further an erotic relationship. To gain sexual satisfaction.

PERSONALITY ASSESSMENT

16. Succorance (Dependency - Insecurity)

Subject tends to crave for affection and tenderness. To avoid being alone, to adopt a pathetic or tragic attitude, to cry for help.

Desires and objects drawn up for each variable
Goals of meeting 1 - 0 -- absence of behavior
1 -- present in slight degree
2 -- present in moderate degree

If you are not quite sure of the exact rating, you may use 1+ and -1 as intermediate steps.

1. Abasement (Sublimation)
2. Achievement (Ambition)
3. Acquisition
4. Aggression
5. Autonomy
6. Blameavoidance
7. Counteraction
8. Defendance
9. Dominance
10. Harmavoidance
11. Inevavoidance (Inferiority)
12. Nurturance (Compassion)
13. Rejection
14. Retention
15. Sex
16. Succorance (Insecurity)

2. Rank in order 1, 2, 3, three of these variables in which, according to your opinion, the patient shows the greatest behavior tendency.

1.
2.
3.

3. What is your general impression of the patient with regard to his personality style?

PERSONALITY ASSESSMENT

Name: Date tested:.....

- Assess the patient on the 16 enumerated behaviour tendencies using for perception and guidance the provided check-list of attitudes, feelings, actions, desires and effects drawn up for each tendency.
Code of marking : 0 -- absence of behaviour tendency
1 -- present in slight degree
2 -- present in marked degree

If you are not quite sure of the exact marking, you may use 1+ and -1 as intermediate stages.

1.	Abasement (Submission)	0	1	2
2.	Achievement (Ambition)	0	1	2
3.	Acquisition	0	1	2
4.	Aggression	0	1	2
5.	Autonomy	0	1	2
6.	Blamavoidance	0	1	2
7.	Counteraction	0	1	2
8.	Defendance	0	1	2
9.	Dominance	0	1	2
10.	Harmavoidance	0	1	2
11.	Infavoidance (Inferiority)	0	1	2
12.	Nurturance (Compassion)	0	1	2
13.	Rejection	0	1	2
14.	Retention	0	1	2
15.	Sex	0	1	2
16.	Succorance (Insecurity)	0	1	2

- Rank in order 1, 2, 3, three of these behaviour variables in which, according to your opinion, the patient shows the greatest behaviour tendency:

-
-
-

- What is your general impression of the patient with regard to his personality make up?

Do you feel that you must suffer before you can achieve your purpose?

1. ABASEMENT (SUBMISSION)

Desires and Effects: To submit passively to external force. To accept injury, blame, criticism, punishment. To surrender. To become resigned to fate. To admit inferiority, error, wrong doing or defeat. To confess and atone. To blame, belittle or mutilate oneself. To seek and enjoy pain, punishment, illness and misfortune.

Feelings: Resignation. Shame, guilt, remorse or contrition. Inferiority or humility. Helplessness or despair.

Attitudes: (a) Abasive, submissive, acquiescent, pliant, meek, humble, servile; (b) Impotent, passive, patient, resigned; (c) Contrite, weak, cowardly.

Actions: To adopt a passive, meek, humble, or servile attitude. To stand aside, take a back seat, let others push by and have the best. To submit to coercion and domination without rebellion or complaint. To allow oneself to be 'talked down'. To accept censure without rebuttal. To allow oneself to be bullied, dispossessed of objects. To receive physical injuries without retaliation. Self-blame, self-accusation.

Probing Questions:

1. Are you often able to hold up your end in a fight?
2. When something goes wrong are you more apt to blame yourself than to blame the other fellow?
3. Are there times when you act like a coward?
4. Are you more apt to give in than to continue a fight?
5. Do your friends think that you are too humble?
6. Do you feel nervous and anxious in the presence of superiors?
7. Are you rather submissive and apologetic when you have done wrong?
8. Are you shy and inhibited in your relations with women (men)?
9. Are you sometimes depressed by feelings of your own unworthiness?
10. Do you feel that you must suffer before you can achieve your purpose?

2. ACHIEVEMENT

Desires and Effects: To accomplish something difficult. To master, manipulate or organize physical objects, human beings, or ideas. To do this as rapidly and as independently as possible. To overcome obstacles and attain a high standard. To excel one's-self. To rival and surpass others. To increase self-regard by the successful exercise of talent.

Feelings: Zest, ambition.

Attitudes: Achievant, ambitious, competitive, aspiring.

Actions: To make intense, prolonged and repeated efforts to accomplish something difficult. To work with singleness of purpose towards a high and distant goal. To have the determination to win. To try to do everything well. To be stimulated to excel by the presence of others, to enjoy competition. To exert "will power".

Probing Questions:

1. Are you driven to greater efforts by ambition?
2. Do you feel that nothing else which life can offer is a substitute for great achievement?
3. Do you feel that your future peace and self-respect depend upon your accomplishing some piece of work?
4. Do you set difficult goals for yourself which you attempt to reach?
5. Do you work with energy at the job that lies before you instead of dreaming about the future?
6. When do you enjoy relaxation most: inbetween periods of uncompleted work or when it follows the successful completion of a substantial piece of work?
7. Do you feel the spirit of competition in most of your activities?
8. Would you say that you work as a slave at everything you undertake until you are satisfied with the result?
9. Do you enjoy work as much as play?

3. AGGRESSION.

Desires and Effects: Physical: To overcome opposition forcefully. To fight. To revenge an injury. To attack, injure or kill an object. To oppose forcefully or punish an Object. Verbal: To belittle, censure, curse or ridicule maliciously an object. To depreciate and slander. Painfully humiliate an object.

Feelings: Irritation, anger, rage (temper tantrum) also revenge and jealousy. Hatred.

Attitudes: (a) Aggressive, combative, belligerent, pugnacious, quarrelsome, argumentative; (b) Irritable, malicious, resentful, revengeful; (c) Destructive, cruel, vindictive, ruthless; (d) Critical, accusatory, abusive; (e) Domineering, severe, despotic.

Actions: To move and speak in an assertive, forceful, threatening manner. To jostle and push objects out of one's way. To curse or blame those who impede one's progress. To adopt a terrifying attitude and take the best by force. To experience 'fits of rage' to scream, to kick and scratch. To strike, to 'pick a fight'.

Probing Questions:

1. When a friend of yours annoys you, do you tell him what you think of him?
2. Do you enjoy getting a person's goat?
3. Do you like physical competition such as football, boxing or wrestling - the rougher the better?
4. Would you protest when a person steps in front of you in waiting line?
5. Do you treat a domineering person as rudely as he treats you?
6. Do you often try to get your own way regardless of others?
7. Do you sometimes use threats of force to accomplish your purpose?
8. Do you easily get into a fighting mood when the occasion seems to demand it?
9. Do you blame other people when things go wrong?
10. Are you considered aggressive by some of your acquaintances?

4. ACQUISITION

Desires and Effects: To gain possessions, to become rich, to acquire wealth.

Feelings: Ambition, longing for material gain. Joy from getting the best of a bargain.

Attitudes: Selfishness. Greediness. A predatory, calculating and acquisitive attitude.

Actions: To gain possessions and property. To grasp, snatch or steal things. To bargain or gamble. To work for money or goods. To bet or play games for money. To accept other peoples' hospitality.

Probing Questions:

1. Do you bet or play games for money frequently?
2. Are you careful in spending money?
3. When doing your shopping do you look for bargains?
4. Are you calculating beforehand how much you can spend?
5. Are you interested in collecting e.g. household goods, linen, wool, money, etc.?
6. Do you like receiving presents?
7. Do you remember what gifts you received for Xmas two years ago?
8. Would you want to become rich?

5. AUTONOMY

Desires and Effects: To get free, shake off restraint, break out of confinement. To resist coercion and restriction. To avoid or quit activities prescribed by domineering authorities. To be independent and free to act according to impulse. To be unattached, unconditioned, irresponsible. To defy conventions.

Feelings: Feeling of restraint. Anger. Independence and irresponsibility.

Attitudes: (a) Autonomous, independent, free, wilful, unrestrained, irresponsible; (b) Rebellious, insurgent, radical, defiant; (c) Negativistic, stubborn, resistant.

Actions: To do as one pleases regardless of rules or conventions. To refuse to be tied down by family obligations or by a definite routine of work. To avoid organized athletics or regular employment. To love adventure and change, or seclusion. To speak one's mind. To defy authority. To demand free speech. To swear "To hell with you". To wander. To seek independence in isolation or be intolerant. To argue against authority. To be 'as obstinate and stubborn as a mule'. Negativism.

Probing Questions:

1. Are you able to do your best work when you are (a) in a subservient position or (b) in an independent position?
2. Do you become stubborn and resistant when others attempt to coerce you?
3. Do you often act contrary to custom or to the wishes of your family?
4. Do you argue against people who attempt to assert their authority over you?
5. Do you try to avoid situations where you are expected to conform to conventional standards?
6. Do you go your own way regardless of the opinions of others?
7. Are you inclined to adopt a course of action dictated by others?
8. Would you disregard rules and regulations that hamper your freedom?
9. Would you demand independence and liberty above everything?
10. Are you apt to criticize whoever happens to be in authority?

6. BLAMAVOIDANCE

Desires and Effects: To avoid blame or rejection (loss of affection). To inhibit narcissistic, asocial impulses and to perform altrophilic or sociophilic acts in order not to be rebuked by other objects. To be inoffensive. The original form of the need is that of escape, i.e., to flee from punishing objects after a misdeed has been committed.

Feelings: Anxiety and apprehension. Guilt feelings and remorse.

Attitudes: (a) Blamavoidant, inhibited, over-anxious, fearful; (b) Scrupulous, unobjectionable, conscientious, conventional, dutiful; (c) Apologetic, remorseful.

Actions: To be concerned about public opinion, what the neighbours will say. To be careful to do nothing that will annoy, antagonize or alienate the affections of others. To be afraid of provoking opposition or hostility. To wonder whether people are disapproving. To inhibit and repress asocial impulses. To be respectable, polite, courteous, proper, ethical.

Probing Questions:

1. Do you feel upset if you hear that people are criticising or blaming you?
2. Do you refrain from expressing unconventional opinions to people who may disapprove of them?
3. Do you apologize profusely when you are blamed for something?
4. Do you keep out of trouble at all costs?
5. Before you do something are you apt to consider whether your friends will blame you for it?
6. Do you ever do anything that will provoke opposition if you can help it?
7. Do you do a great many things just to avoid criticism?
8. Do you feel ashamed if you are told that you have acted selfishly?
9. In coming to a decision do you always take other peoples' interests into account?
10. Do you take pain not to incur the disapproval of others?

7. COUNTERACTION

Desires and Effects: To master or make up for a failure by restriving. To obliterate an humiliation by resumed action. To overcome weakness, to repress fear. To efface a dishonour by action. To search for obstacles and difficulties to overcome. To maintain self-respect and pride on a high level.

Feelings: Shame after failure or an exhibition of cowardice. Determination to overcome. Pride. Zest for restriving.

Attitudes: Counteractive, resolute, determined, indomitable, dauntless, dogged, adventurous.

Actions: The actions are the same as those of Achievement, with this addition: they are done for pride's sake or for honour's sake. To re-enact after a trauma the same event until anxiety is mastered or, after a failure, to try to accomplish that very thing. The activity that is required depends upon the kind of humiliation that has occurred. The need counteraction is usually focal. For instance: Restriving for Achievement, (Econ.): To attempt to make up a financial loss. Traumatic Restriving (Accident): to make efforts to deal successfully with a formerly traumatic situation. To accomplish things unaided.

Probing Questions:

1. Do you often do something just to prove that you can do it?
2. Do you enjoy dangerous undertakings?
3. Do you try to work out things for yourself when you are in trouble?
4. Do you usually refuse to admit defeat?
5. When you get bad news, do you hide what you feel and behave as if you didn't care?
6. Do you go out to meet trouble rather than to try to escape it?
7. Is a difficulty to you a spur to greater effort?
8. Do you feel sometimes that you must do everything yourself, that you can accept nothing from others?
9. Would you rather go without something than to ask a favour?
10. Do you usually refuse to admit that you are tired or disappointed when you are?
11. Do you often refuse to take suggestions from others out of pride?
12. Do you prefer difficult tasks to easy ones?

8. DEFENDANCE

Desires and Effects: To defend the self against assault, criticism and blame. To conceal or justify a misdeed, failure or humiliation. To vindicate the Ego.

Feelings: Guilt feelings, inferiority feelings. Anxiety, Indignation.

Attitudes: Defendant, self-defensive, self-vindicative.

Actions: The subject defends himself physically. The subject defends himself verbally. He is 'on his guard'; bristles when criticized; has a 'chip on the shoulder'; interprets harmless remarks as slurs. He suppresses his inaptitudes. He resists inquiries into his private affairs. He will not admit guilt under fire. He is ready with excuses. He 'argues back'. To deny or refuse to admit guilt, inferiority, weakness. To rationalize it away as unimportant.

Probing Questions:

1. Can you always think of something to say in your own defence?
2. Are you put on your guard by anybody who seems to want to know about your personal affairs?
3. Are you apt to get into arguments with people who criticize your way of living?
4. Do you keep your private feelings concealed behind a wall of reserve?
5. If you believe some man is going to snub you, do you snub him first?
6. Are you usually unwilling to admit that you are in the wrong?
7. Can you usually find plenty of reasons to explain your failure?
8. Are you on the defensive when your abilities are being tested?
9. Do you usually manage to justify your conduct, to yourself and others?
10. Do you stick to your own opinions when you are opposed?

9. DOMINANCE

Desires and Effects: To control one's human environment. To influence or direct the behaviour of objects by suggestion, seduction, or command. To dissuade, restrain, or prohibit. To induce an object to act in a way which accords with one's sentiments and needs.

Attitudes: Dominative, forceful, masterful, assertive, decisive, authoritative, executive, disciplinary.

Feelings: Confidence.

Actions: To influence, sway, lead, prevail upon, persuade, direct, regulate, organize, guide, govern, supervise. To master, control, rule, over-ride, dictate terms. To judge, make laws, set standards, lay down principles of conduct, give a decision, settle an argument. To prohibit, restrain, oppose, dissuade, punish, confine, imprison. To magnetize, gain a hearing, be listened to, be imitated, be followed, set the fashion. To be an exemplar.

Probing Questions:

1. Do you enjoy organizing or directing the activities of a group, family, club, or committee?
2. Do you argue with zest for any point of view against others?
3. Do you find it difficult to lead a group of boys and maintain discipline?
4. Do you usually influence others more than they influence you?
5. Who makes the necessary decisions when you are with another person?
6. Do you think you could be the leader in a social situation?
7. Do you enjoy the sense of power that comes when you are able to control the actions of others?
8. Whatever you do, do you have confidence in your own actions?

10. HARMAVOIDANCE

Desires and Effects: To avoid pain, physical injury, illness and death. To escape from a dangerous situation. To take precautionary measures.

Feelings: Fear, anxiety, apprehension, fright, terror, trembling, sweating, pallor, stammering, verbal disjunctivity.

Attitudes: (a) Apprehensive, fearful, anxious, timid, frightened, panic stricken; (b) cautious, hesitant, wary, prudent, careful, vigilant.

Actions: To avoid danger. To be cautious and hesitant about undertaking something. To hang back; shun, evade, or shrink from a perilous situation. To recoil, retreat, draw back, withdraw or flee from danger. To avoid infection. To avoid contact with contaminated objects. To take measures to prevent illness; to wear rubbers or a heavy coat, to abstain from alcohol and certain foods, to be innoculated. To take drugs. Fear and avoidance of illness and death. Hypochondria. Bodily phobias: fear of heart disease, cancer, stomach trouble, etc.

Probing Questions:

1. Do you avoid passing through certain districts at night on account of a vague fear of assault?
2. If you were challenged to a fight do you think that you would be timid and fearful?
3. Do you fear certain things, such as lightening, high places, rough water, horseback riding, etc.?
4. Are you conscious of a vague fear of death?
5. Are you afraid of physical pain?
6. Do you sometimes experience a vague dread that you may be attacked by someone?
7. Do you sometimes fear that you may be injured in an accident?
8. Are you afraid of certain animals: snakes, bulls, watchdogs?
9. Are you somewhat afraid of the dark?
10. Are you apt to be apprehensive when you are alone in an empty house at night?

11. INFAVOIDANCE (INFERIORITY)

Desires and Effects: To avoid humiliation. To **quit** embarrassing situations or to avoid conditions which may lead to belittlement: to scorn, or indifference of others. To refrain from action because of the fear of failure.

Feelings: Inferiority feelings. Before and during an event: nervousness, anxiety, embarrassment. After the event: shame, mortification.

Attitudes: Infavoidant, sensitive, shy, nervous, embarrassed, self conscious, shrinking.

Actions: To avoid doing or to stop doing something which one does not do well. To avoid repeating a failure. To be hesitant to make friendly advances. To fear rejection. To be afraid to propose marriage. To avoid tests of strength and athletic skill. To avoid doing things in public. To avoid strangers or critical audiences. To avoid the company of superior contemptuous objects. To associate with inferiors. To get sick in order to avoid a difficult situation or test. To escape participation by staying in bed. To hide certain parts of the body. To conceal ignorance. To avoid certain topics of conversation. To conceal humiliating facts.

Withdrawal: In the midst of a humiliating moment to retreat, retire or to take flight. To slink out with 'tail between legs'. To resign, change one's job, leave the country.

Probing Questions:

1. Do you worry a lot about your ability to succeed?
2. After you have made a poor showing before others, do you usually recall the occasion with distress for a long time?
3. Do you often avoid open competition because you fear that you may appear in a bad light?
4. Do you get rattled when you have to speak before a group?
5. Do you usually lack self-confidence when you have to compete against others?
6. Do you feel that your self-esteem has been shaken when you fail at something?
7. Do you keep in the background when you are with a group of confident and boisterous people?
8. Do you feel nervous if you have to meet a lot of people?
9. Do you hesitate to put your abilities to the test, because you dread the humiliation?

12. NURTURANCE (Compassion)

Desires and Effects: To give sympathy and gratify the needs of helpless objects: an infant or any object that is weak, disabled, tired, inexperienced, infirm, defeated, humiliated, lonely, dejected, sick, mentally confused. To assist an object in danger. To feed, help, support, console, protect, comfort, nurse, heal.

Feelings: Pity, Compassion, tenderness.

Attitudes: (a) Nurturant, sympathetic, compassionate, gentle, maternal; (b) Protective, supporting, paternal, benevolent, humanitarian; (c) Indulgent, merciful, charitable, lenient, forbearing, forgiving, tolerant.

Actions: To be particularly attracted to young, the unfortunate, the sorrowing. To enjoy the company of children and animals, to be liberal with time, energy and money when compassion is aroused. To be moved by the distress of others. To feel more affectionate when an object exhibits a weakness. To be moved by tears. To refrain from bothering or annoying an object. To be lenient and indulgent. To give freedom. To condone. To become indignant when children are maltreated. To do things to gratify the needs of an inferior object. To embrace, support, defend. To give refuge. To encourage, pity, console, sympathize with an unhappy object. To express condolence. To calm, appease, pacify, encourage with praise. To be generous with one's ideas. To be tolerant of the theories of others.

Probing Questions:

1. Do you take pains not to hurt the feelings of subordinates?
2. Do you enjoy the company of younger people?
3. Do you give your time and energy to those who ask for it?
4. Are people apt to tell you their innermost secrets and troubles?
5. Are you easily moved by misfortunes of other people?
6. Are you drawn to people who are sick, unfortunate or unhappy?
7. Are you considered by some of your friends as too good-natured, too easily taken in?
8. Do you praise or otherwise encourage people who are depressed?
9. Do you as a rule sympathize with people more often than you blame them?
10. Do you enjoy playing with children?

13. REJECTION

Desires and Effects: To separate oneself from an undesired object. To exclude, abandon, expel, or remain indifferent to an inferior object. To snub or jilt an object.

Feelings: Disgust, scorn, boredom, indifference.

Attitudes: (a) Rejective, exclusive, forbidding, scornful, aloof, haughty, snobbish; (b) Insulated, detached, indifferent; (c) Discriminating, critical, selective.

Actions: Vulnerability to annoying, coarse, rude, vulgar, stupid, boring, childish, mean, cheeky, presumptuous, unattractive objects. To be sensitive, easily repelled, hard to please. To adopt a disdainful, forbidding, superior attitude. To remain aloof and indifferent. To be a severe critic. To be unwilling to suffer fools. To demand a high standard of ability, intelligence, wit or imagination. To be very discriminating and critical in the choice of friends. To reject a suitor. To break with a friend. To withhold love. To debar unpleasant objects. To close and lock the door. To avoid meeting stupid people. To cross the street, refuse invitations. To refuse to admit, invite, shake hands with, or marry an inferior. To drop a friend. To leave home. To resign from a group. To avoid people. To seek solitude. To be different from inferior objects. Not to do as others do. To be distinguished by contrast. To criticize other objects scornfully. To blame other objects scornfully.

Probing Questions:

1. Are you intolerant of people who bore you?
2. Do you maintain a dignified reserve when you meet strangers?
3. Are you very discriminating in your choice of friends?
4. Do you get annoyed when some fool takes up your time?
5. Are you offended by the tastes of many people you meet?
6. Do you usually ignore rather than attack an opponent?
7. Do you feel superior to certain forms of competition?
8. Do you often cross the street to avoid meeting someone you know?
9. Are you scornful of people whose ideas are 'stupid'?
10. Are you repelled by people with bad manners?
11. Do you prefer the company of older, talented or generally superior people?

14. RETENTION

Desires and Effects: To retain possessions of things.

Feelings: Fear of being dispossessed, or being "cheated".

Attitudes: Retentive, economical and miserly attitude.

Actions: To refuse to give or lend. To hoard. To be frugal, economical and miserly. To accumulate and pile up possessions. To conserve possessions. To block up "treasures". To have fantasies or dreams of being dispossessed or robbed.

Probing Questions:

1. Do you look after your personal possessions well?
2. Do you lend your possessions willingly?
3. Do you think that business men are honest?
4. Are you planning how much you can spend?
5. Do you often give presents to your relatives or friends?
6. Do you discard your old clothes or do you keep them?
7. Have you many things of "sentimental" value in your possession?
8. Do you give things away easily?
9. Do you have more pleasure to be with a woman than with a man?
10. Do you sometimes lose yourself in extravagant sexual fantasies?
11. Do you have difficulties controlling your sexual impulses?
12. Are you attracted by every good-looking woman you see?
13. Do you regard every attractive woman with searching curiosity, looking her over from head to foot, measuring, discriminating, estimating possibilities?
14. Do you prefer women who have strong sexual appeal?
15. Have you had a good deal of actual sex experience?

15. SEX

Desires and Effects: To form and further an erotic relationship. To have sexual intercourse.

Feelings: Erotic excitement, lust, love.

Attitudes: Erotic, sensual, seductive.

Actions: To make advances, to 'pick-up' a man or a woman, to seduce a sexually appealing object. To enjoy the company of the opposite sex, to be fond of mixed parties, to like dancing. To be in love. To desire only the chosen object: To work and play together, excluding others; to exchange sentiments and ideas. To hold hands, embrace, kiss, copulate. To flirt, praise, express sympathy, make love. Erotic fantasies and dreams.

Probing Questions:

1. Do you spend a great deal of time thinking about sexual matters?
2. Do you fall in love easily?
3. Do you feel that your sexual instinct is as strong as your ambition?
4. Do you have more pleasure to be with a woman than with a man?
5. Do you sometimes lose yourself in extravagant sexual fantasies?
6. Do you have difficulties controlling your sexual impulses?
7. Are you attracted by every good-looking woman you see?
8. Do you regard every attractive woman with searching curiosity, looking her over from head to foot, measuring, discriminating, estimating possibilities?
9. Do you prefer women who have strong sexual appeal?
10. Have you had a good deal of actual sex experience?

16. SUCCORANCE (DEPENDANCY - INSECURITY)

Desires and Effects: To have one's needs gratified by the sympathetic aid of an allied object. To be nursed, supported, sustained, surrounded, protected, loved, advised, guided, indulged, forgiven, consoled. To remain close to a devoted protector. To have always a supporter.

Feelings: Anxiety of helplessness, feelings of insecurity, forsakenness, despair.

Attitudes: Succorant, dependant, helpless; for born, grieving, tragic; suppliant, petitioning, begging, pleading.

Actions: To be particularly drawn to sympathetic objects who are in position to give advice, aid or support. To crave affection and tenderness. To blossom when treated with kindness. To accept favours unhesitatingly. To enjoy being fussed over. To avoid being alone. To weep, adopt a pathetic or tragic attitude. To cry for help. To exaggerate an injury, an illness, a mental symptom. To complain of being miserable, depressed, sad, worried, tired. To seek advice.

Probing Questions:

1. Do you feel anxious and uncertain when you are suddenly faced by a critical situation?
2. Do you usually tell your friends about your difficulties and misfortunes?
3. Do you prefer to have some friend with you when you receive bad news?
4. Do you think of yourself sometimes as neglected or unloved?
5. Do you find that tears come to your eyes rather easily?
6. Do you feel lonely and homesick when you are in a strange place?
7. Do you like sympathy when you are sick or depressed?
8. Do you experience a vague feeling of insecurity when you must act on your own responsibility?
9. Are you rather easily discouraged when things go wrong?
10. Are you rather dependent upon the presence and judgement of your friends?

SUBJECTS SELF-ASSESSMENT (PERSONALITY)

The 16 behaviour variables, on which the subjects were assessed in the interview, were given descriptive form and were used in setting up a questionnaire individually prepared for each subject. Instead of the first person (I), the third person (He or She) was used in order not to embarrass the subjects when they tried to identify their feelings, desires and actions, and also to promote spontaneous projection.

The descriptive form of behaviour variables was as follows:-

1. Abasement: He felt inferior, helpless and ashamed, and tried to adopt a passive or humble attitude, or in other words, he let somebody else have his way.
2. Achievement: He felt ambitious, wanting to achieve something and he tried to achieve this by intense, prolonged and repeated efforts (by hard work).
3. Aggression: He felt irritated and angry, and tried to overcome his obstacles by verbal or physical force.
4. Acquisition: He felt that he had to gain some possessions (property, money), or to increase his business or other gains.
5. Autonomy: He felt restrained and angry and he tried to get free from this restraint - by doing just as he pleased.
6. Blamavoidance: He felt anxious and guilty and was very sensitive to public opinion. He tried to avoid all this by being respectable and polite, or by a desire to get away from it.
7. Counteraction: He felt ashamed or humiliated because of his failure, and he tried to overcome it by hard work to save his pride.

8. Defendance: He felt indignant and anxious and had to defend himself against assault or criticism.
9. Dominance: He felt confident and tried to influence or direct others; or, he felt that he was right and others had to listen and do as he told them.
10. Harmavoidance: He felt anxious and fearful and tried to avoid pain, danger, disease, misfortune, or even death.
11. Infavoidance: He felt shy, humiliated and embarrassed, and he tended to avoid repetition of his failure.
12. Nurturance: He felt pity and sorry for someone or something and he tried to give sympathy and be helpful to somebody in need or danger.
13. Rejection: He felt bored and disgusted and he had to separate himself or avoid this undesired situation by getting rid of the disliked object or person.
14. Retention: He felt that he could not separate from somebody or something and had to refuse to let it go.
15. Sex: He felt erotically excited and tried to find sexual satisfaction.
16. Succorance: He felt anxious, helpless and insecure and he had to seek sympathetic understanding, support and affection from someone.

SAMPLE OF SUBJECT'S SELF-ASSESSMENT QUESTIONNAIRE.

Name: Date:

If somebody in your place would have felt and would have had to act like you did just before you got your last pains, would you say:

- 1. He felt irritated and angry, and tried to overcome his obstacles by verbal or physical force. Yes. No.
- 2. He felt that he had to gain some possessions (property, money) or to increase his business or other gains. Yes. No.
- 3. He felt restrained and angry and he tried to get free from this treatment by doing just as he pleases. Yes. No.

If none of these descriptions fits into the feelings and urge of actions and expectations you experienced just before you got your pains - state briefly how you felt and what would you most likely have done if you were allowed to express yourself freely?

Personal difficulty in location
"Burning" ear.
Constant noises in ear.

Noise and Throat System

Constantly running nose.
Hay fever.
Peculiar odors.
Frequency of clearing the throat.
Shaking, lurch in the throat.
Frequency of coughing.
Loss of voice.
Sore throat (frequency of).
Singing.
Slightly hoarse voice.

LIST OF POINTS COVERED IN THE ASSESSMENT OF
SUBJECT'S DISRUPTION OF BEHAVIOUR.

1. Head and Nerve Symptoms:

Headache - severity and frequency.
Dizziness and fainting.
Nervous breakdown.
Numbness and tingling - in any part of the body.

Irritability - "jumpy" nerves.
Any other nervous complaints.
Stammering and stuttering.
Head colds.

2. Eye Symptoms:

Blackouts.
Blinking or watery eyes.
Pain in eyes.
Blurred vision.
Eye strain.

3. Ear symptoms:

Occasional difficulty in hearing.
"Burning" ear.
Constant noises in ear.

4. Nose and Throat Symptoms:

Constantly running nose.
Hay fever.
Peculiar odours.
Frequency of clearing the throat.
Choking, lump in the throat.
Frequency of coughing.
Loss of voice.
Sore throat (frequency of)
Sinusitis.
Difficulty in swallowing.

5. Heart Symptoms:

Palpitations or heart "thumping".
Pain over heart.
Heart trouble.
High blood pressure.

6. Lung Symptoms:

Breathlessness.
Sense of suffocation or breathing oppression.
Asthma.
Sighing.
Frequent coughing.

7. Digestive Tract Symptoms:

Lack of appetite.
Dry mouth.
Flatulence.
Belching after eating.
Periodical vomiting.
Constipation.
Diarrhoea.
Kidney and liver trouble.
Colitis.
"Fullness" in stomach.

8. Muscular Symptoms:

Aches and pains.
Stiffness.
Tremor and twitching.
Weakness of limbs.
Paralysis of parts of the body.

9. Skin and Vaso-motor Symptoms:

Sweating, even in cold weather.
Tenderness.
Itching.
Sweating of hands.
Nocturnal perspiration.
Flushing, blanching.
Coldness and blueness of extremities.
Shivering.

10. General Symptoms:

(a) Sleep.

Difficulty in falling asleep or staying asleep.
Poor sleep at night, difficulty on waking in the morning.
Walking in sleep.
Dreaming.
Nightmares.

(b) Sickness.

Frequency of illness.
Interference of sickness with work - ("off sick").
Worry about health.
Feeling poorly.

(c) Fatigue.

Easy physical fatigue.
Easy mental fatigue.
Inability to concentrate.
Poor memory.
Inability to rest.
Boredom.
Lack of interest or a quickly disappearing interest.
Nervous exhaustion.
Spells of complete fatigue.
Tiredness and exhaustion on waking.
Excessive irritability.

(d) Anxiety.

Stage fright.

Anxiety or fear of closed spaces, (e.g. tunnels, lifts).

Fear of insanity.

Any particular irrational fear.

Night terrors.

Hurried speech.

(e) Excitability.

Frequency of being excited.

Emotional expression (e.g. embarrassment, anger, elation, affection, grief brought about on slight provocation).

Passionate speech.

Exhibition of marked fluctuations of mood (e.g. happiness - depression).

Attacks of shaking and trembling.

Emotional instability, (e.g. crying and giggling).

Increased sensitivity to bright light, noise and cold.

Long worry over humiliating experiences.

Shyness.

Easy interference with feelings, (easily hurt).

Difficulty in making friends.

Worry over possible misfortunes.

Frequency of depression.

Sensitivity to criticism.

LIST OF POINTS COVERED IN THE ASSESSMENT OF
SUBJECT'S BODILY PREOCCUPATION.

1. Interest expressed in his body and bodily functions by way of:
 - (a) talking (complaining),
 - (b) thinking (worrying),
 - (c) taking medicines or employing other measures to prevent illness.

2. Concern with body weight.

3. Degree of awareness (feeling) of bodily functions, i.e.g. working of heart, lungs, intestines, cracking joints etc.

4. Anxiety over bodily functions and well being.

5. Fear of death.

6. When did he become aware of pain or discomfort?
 - (a) after illness,
 - (b) after accident,
 - (c) by example (noxious influence of environment),
 - (d) just came on.

7. Degree of interference of illness in his work.

WORD ASSOCIATION TEST

8. Does small complaint put him into bed?
Is he considered a sickly person?

Stimulus word Time Response I Response II Remarks

9. How often does the subject attend his physician's surgery?
1. Twice
2. Day
10. Malingering.
11. What is the subject's intention of gain through malingering?
1. (a) protection and sympathy,
2. (b) exemption - escape,
3. (c) privileges and rewards (compensation).

10. Sad
11. Dislike

12. Lost

13. Cost

14. Guilt

15. Fear

16. Trouble

17. Pain

18. Sick

19. Guilt

20. Sick

21. Sick

22. Trouble

23. Pain

24. Sick

25. Sick

WORD ASSOCIATION CARD

Name: Date tested:

Stimulus Word	Time	Response I	Response II	Remarks
1. Glass				
2. Table				
3. Dog				
1. home				
2. fed-up				
3. inferior				
4. bed				
5. criticism				
6.				
7. husband				
8. shame				
9. death				
10. happy				
11. disgust				
12.				
13. lost				
14. rest				
15. guilt				
16. swear				
17. trouble				
18.				
19. child				
20. ambition				
21. kick				
22. sympathy				
23. pain				
24.				
25. sex				

Stimulus Word	Time	Response I	Response II	Remarks
26. body				
27. pity				
28. helpless				
29. stick				
30.				
31. loneliness				
32. trouble				
33. blame				
34. argue				
35. success				
36.				
37. superior				
38. injury				
39. failure				
40. refuse				
41. tragedy				
42. health				
43. worry				
44.				
45. shy				
46. help				
47. anger				
48.				
49. quarrel				
50. freedom				

Remarks in general:

N.B. In the 8 blanks were written words individually prepared for each subject.