CEREBRAL PHYSIOLOGY AND PSYCHIATRY.

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INTRODUCTION.

This contribution is itself introductory to a larger subject, and is an attempt to present some physiological observations in a way that may stimulate the interest of psychologists and psychiatrists. Viewed from a biological standpoint, man is limited in his thinking and behaviour by his innate constitution, anatomically and physiologically. As a living, functioning individual he is much more than the mere sum of his parts, yet it is a fact that structurally he is made up of reflex arcs (receptor endorgans, afferent nerves, central nervous system, efferent nerves and effector organs). The vital functions of nutrition, respiration, circulation, excretion, reproduction, locomotion and metabolism are effected by standard types of reflexes which pervade the vertebrate kind, so that a dynamic reflexological approach to normal and abnormal human behaviour should be revealing. Man is stimulated by his total environment to respond as a complete being, and this full activity is retained as experience which modifies subsequent behaviour. That being so, the nature of integration of these reflexes and the ways in which they are influenced by experience constitute a subject very pertinent to the study of psychology and psychiatry. Something of that nature forms the material of this paper.

To ensure a scientific basis, only such observations are noted as have been made personally, on the actual abnormal behaviour of patients or on the investigation of that behaviour through speech with the patients, or more usually by the use of both methods. The observations on the development of behaviour were made in the course of investigating the "life history" of patients by interviewing them and their relatives.

The conclusions concerning children were developed at child guidance clinics, but perhaps more fruitfully by informal observations on the families of my friends. The unobtrusive visitor to the home of enlightened parents has a strategic advantage, and is able to observe the spontaneous activities of children, and in discussion with the parents to acquire a more intimate and detailed record.

The interpretation given to the observed facts derives from an appreciation of the experimental studies of various schools of neurophysiology, as is brought out in the ensuing context.
First of all an outline of differentiation in the Pavlovian sense is given, together with the changes this undergoes with the onset of sleep and in neurotic breakdown. With such understanding of animal behaviour as this affords, instinctual human behaviour is then considered in health and disorder. Next, a physiological interpretation of ambivalent behaviour in psychiatry and the analysis of an actual case from a physiological viewpoint is given. A short discussion of some implications of this work completes the article.

1. Experimental Basis of Differentiation in Animals.

Positive Conditioning.

The approach adopted here is based on the studies of Pavlov (1) and Horsley Gantt (2), and the relevant experiments show that if such a stimulus as the musical note C, lacking any capacity to evoke a stereotyped response, immediately precedes an injurious stimulus which does possess such a capacity, then the former stimulus acquires a new property of evoking the withdrawal response previously produced by the neural impulses of the latter only. This acquired property develops with repetition.

If, after establishing positive properties to the note C one sounds a note adjacent to it, such as D, one finds that D has acquired like properties. The cortical engrams corresponding to notes further removed, such as G, are also positive to a lesser measure. The important point of principle here is that through an internal neural process, an inaccuracy in the registration of actual experience has occurred. Because C has positive effect for a vital function, D and G have similar effect in lessening degree. In nature this is valuable, for similar environmental stimuli tend to have similar effect for an animal. However, another function of the cortex— inhibition— tends, with experience, to limit this inaccuracy, and it is effected through negative conditioning.

Negative Conditioning.

If a stimulus which has acquired positive properties acts on the sensorium and is not followed by its basic inborn reflex, it develops the negative property of reducing that inborn response. This new inhibitory property is built upon outmoded positives. It develops with repetition.

Differentiation—the Combination of Positive and Negative Conditioning.

If note C is always associated with a painful stimulus, it acquires positive withdrawal effect, and if notes D and G, which have acquired spontaneous positive effect only through internal generalization, are always non-reinforced, they lose this property and then are inhibitory. This combined activity of positive and negative engrams based upon the same inborn reflex is called differentiation. It will be clear that an increased selectivity to environmental stimuli is effected by this combination, for the cortex now induces positive activity to C and negative activity to D and G (whereas formerly D and G were merely "less positive.").

Cortical engrams thus vary in degree of both positiveness and negativeness, and may work with or against each other according to determinable laws.
These influence, and themselves are influenced by, the state of the unconditioned centre of the basic reflex system. These interacting processes are constantly changing.

The unconditioned reflex with its positive and negative associations together form the basic unit, structurally and functionally, for the study of neural dynamic changes occurring in biological adaptation.

**Differentiation during the Onset of Sleep and in Neurosis.**

In the normal waking state a "large" stimulus results in a large conditioned response and a "small" stimulus results in a small conditioned response. During the transition to sleep and in neurotic breakdown, it is found that the cerebral cortex passes through distinct phases of functional activity. The first of these is the equivalent phase, in which stimuli of large and small intensities give responses of the same size. This passes into the paradoxical phase, in which stimuli of large intensity evoke small responses and stimuli of small intensity evoke large responses. The last phase is the ultraparadoxical, where reversal of effect obtains, positively conditioned stimuli then giving negative responses and negatively conditioned stimuli giving positive responses. These phases should be borne in mind when abnormality of the differentiating function is being considered.

2. **THE NORMAL AND ULTRAPARADOXICAL PHASES IN INSTINCTUAL BEHAVIOUR IN MAN.**

A child is born with a minimum of learned behaviour from the recency of completion of its nervous system and the constancy of its intrauterine environment. Yet it has the faculty to record conditioned behaviour.

**Nutrition.**

In the beginning, the stimuli preceding the fulfilment of the nutritional function are relatively stereotyped because the food is milk and the source—the mother. The sight of the breast, the contact of the breast with the child's hands, face and mouth, being the most immediate precursors, all become of positive effect. Gradually, the sights and sounds of the mother as an individual become conditioned stimuli to the unconditioned food reflexes. By differentiation, the father and other people, having become positive through internal generalization since they resemble the mother, will tend to become of negative conditioned sign as they are not followed by reinforcement.

As the feeding habits widen in scope a host of olfactory, visual, auditory and gustatory stimuli acquire positive effect as they impinge upon the child's sensorium prior to food. The sight and smell of food and the noise of dishes, the activity of preparation and the sight of others eating are of this category. There is, therefore, another group of objects which acquire positive effect through internal generalization arising through the resemblance they bear to actually positive objects of food and drink. So faeces and urine, solid and fluid poisons, blankets, clothes, hands, toys and other objects, coal and dirt, slops and soap, after acquiring this positive significance (for the child puts
these to its mouth without discrimination) undergo negation by differentiation. The child's sensorium is stimulated by them, yet the child is prevented from eating them, so by non-reinforcement they become negative. In this way the mature differentiated systems in the adult are built up through a long process of development from childhood, and one system supersedes previous systems as living conditions change.

It is evident that the mature cerebral cortex has in the course of its existence built up differential systems through experience based upon the instinctual functions. These systems ensure that the organism, in adapting its vital functions and the environment to each other, works realistically in accordance with its previous history. It will clearly respond positively in one environment and negatively in another.

Mental health is characterized by just such efficient adaptation. The change occurring in the differential systems in the severe mental disorder schizophrenia is one of partial or complete reversal, and the syndrome is the expression of a cerebral cortex in the ultra-paradoxical phase. These cases are generally described as having lost all interest in their former pleasures and pursuits on the one hand, on the other as having depraved, suicidal or antisocial habits. These are but two inseparable aspects of the one phenomenon — differentiation—for by reversal in the course of intracortical disfunction, the subject responds positively in a situation that is negative in his total experience, and negatively (by inhibiting a response) in any situation that is positive in his experience. These reversals of acquired differential systems based upon inborn reflexes take many and various forms. Though determined by the individual experience of the subject, they do conform to general type, as is shown by the following behaviour patterns which are commonly observed in mental hospital practice.

In nutrition, food and drink assume a negative effect and the patient refuses to eat and inhibits digestive secretions, treating the food as dangerous and disgusting. Poisons, faeces and urine, clothes, hands, dirt and many other articles normally of negative moment through differentiation become of positive sign for feeding and are treated accordingly. A mother or mother-object will also become negative for nutrition and may then be regarded as a poisoner. Sometimes clear-cut reversal of positive and negative associations does not develop, but the tendency to such a state exists in the form of mixed associations. Such patients respond to food as if it were contaminated or poisoned by some agent or substance.

The above is a brief outline of the development of conditioned differential systems and their complete or partial breakdown as illustrated in the nutritional responses. The analogous processes in the remaining groups of reflexes fall to be considered.

**Excretion.**

The defaecating and urinating reflexes fulfil the excretory function (excluding the actual secretion of urine and sweat). The adequate unconditioned stimuli are distention of the rectum and the urinary bladder. The response is voiding of these viscera through muscular action, i.e. contraction of the...
extrusors and relaxation of sphincters. Training consists in placing the child in a suitable environment prior to the action of these reflexes. The mother thus, in a young child, becomes a positive condition for these functions, and the sight and touch of the lavatory or chamber pot will become immediate conditions. By differentiation, the clothes and bedding, floor and furniture become of negative effect. These objects, initially positive by internal generalization or by actual experience, undergo inhibition by non-reinforcement in training.

In the ultraparadoxical phase, clothes, beds, floors and so on acquire the property of evoking the response of voiding, and that this is not merely incontinence (i.e. uncontrollable defaecation or urination) is observed in the "purposefulness" and "deliberateness" of the behaviour. On the other hand, the lavatory, commode or bedpan tend to negative sign, and the patients are said to be restraining the act or to be "holding themselves in" when placed in what are normally appropriate conditions for excretion.

**Locomotion.**

The locomotor function is constituted by all reflexes resulting in movements destined to preserve the life or integrity of the organism. Thus stimuli, injurious to the skin causing withdrawal of the part; loud noises causing starts; sudden visual stimuli causing protective motor responses; proprioceptive stimuli causing as their inevitable response maintenance of any passive or active movement; grasp and other prehensile reflexes; the phasic reflexes in walking, trotting, running and galloping—all these constitute the locomotor function.

Dangerous objects become, then, of positive moment for the locomotor function and excite withdrawal movements. The total environmental stimulus constituting safety and comfort, by differentiation, acquires negative effect, and inhibits movement away from safe and comfortable environments towards danger. Such positive and negative behaviour is advantageous for survival. In these reflexes it is important to distinguish clearly between positive and negative conditions. Many behaviourists tend to confuse a physiologically positive conditioned stimulus based on this reflex system, and resulting in movement away and unpleasant feeling tone (e.g. flexor reflex) with the physiologically negative which, in reality, results in no response or the lessening of an already existing response.

Positive conditioned stimuli arise from objects which impinge on the sensorium prior to injury, spankings, overbalancing and so on. Wall, tables, windows, furnishings, fires, electrical, gas and other heating and lighting equipment, stairs, motors, streets, railways, bridges, rivers, water, heights, uncomfortable postures, falling out of bed and many more such factors acquire positive sign by direct experience, or indirectly through warnings and training on the part of adults. Negative stimuli based by differentiation on the locomotor reflexes arise from factors such as constitute safe and comfortable postures, absence of the above dangerous objects—for such situations constitute a stimulation of the sensorium just as material as the disturbing factors which are positive.
It becomes clear how differentiations based on the locomotor function (excluding the highly developed systems involved in manipulatory and speech behaviour) determine the movements not merely avoiding danger and injury but also those maintaining safety and integrity. The value of this twofold conception becomes evident when reversal of the biological significance of environment is dealt with in functional disorder as in the ultraparadoxical phase.

This phase of the cortex determines excitatory responses away from safety and comfort towards danger and injury, and inhibitory responses maintain a state of constant danger. Therefore walls, tables, windows, fires, etc., as enumerated above become of negative sign for self-preservation, while objects constituting a safe, comfortable and pleasing environment become of positive sign. The abnormally functioning cortex through internal reversal of its orientating, guiding influence upon the inborn reflexes impels the subject to court danger and death and, as he would normally avoid these, so he avoids security and ease. Such complete reversal is only obvious periodically as "impulsive suicidal outbursts" in a chronic case, or more continuously in cases classified as "acute schizophrenic breakdowns." More characteristic of the confirmed schizophrenic is the inactivity which results from the mixed associations which reveal the tendency towards the ultraparadoxical phase. Here any given environment excites movement and at the same time inhibits movement, and relative inactivity ensues.

Respiration.

The respiratory function consists of reflexes of inspiration, expiration, coughing and sneezing. Respiration is naturally maintained by the subject taking measures to ensure the free supply of air. The ultraparadoxical phase may cause the subject to avoid air and attempt suicide by suffocation, drowning, strangulation, choking or gassing.

Circulation and Metabolism.

Some systems of reflexes are difficult to analyse in terms of reversed differentiation, since responses are not readily observable clinically. Such are the circulatory and metabolic systems. The former is effected by many reflexes. Briefly there is throughout the whole body a mass of effector units controlling the rate and output of the heart and relative tone of the arterioles, so achieving a distribution of blood according to the needs of the moment. These reflexes, like the respiratory, are not subject to inhibition to the extent of extinction: yet the response patterns are attuned to environmental changes. Abnormal responses are made in functional disorder.

The metabolic function is complex, and in its conditioned reflex aspect is difficult to analyse. Emergencies, hot and cold surroundings, evoke reflexly, responses maintaining the constant "milieu interne." When food and fluid are ingested, digested and absorbed, such substances as insulin are secreted to effect assimilation. Fluid intake usually preceding as it normally must, the renal secretion of the resulting excess of fluid in the body actually conditions its own excretion. These are some of the known reflex mechanisms of
It is a fact that many of these deep reflexes can be conditioned positively and negatively. The severe physical effects such as loss of weight and \textit{toxaemia} in mental disorders are partly accountable to functionally disordered metabolic reflexes.

\textit{Reproduction.}

The reproductive function is fulfilled by three systems of inborn reflexes. Firstly there are the reflexes associated with menstruation and ovulation, gestation and parturition. These are not so obviously subject to conditioning but are to a varying degree.

Secondly there are the lactational reflexes ensuring a food supply for the infant. It has already been indicated that the mother becomes of positive sign (for feeding) to the child in this relationship. It is also true that the child is of positive sign to the mother for lactation, because visual, auditory, tactile, proprioceptive and olfactory stimuli originating from the child and impinging on the mother's sensorium precede the stimulation of the nipple receptors and the inborn reflex secretion of milk. This means that stimuli from the child evoke secretion of milk and that, at weaning, the child becomes of negative effect to the mother for lactation and the cortical engrams of those stimuli undergo negation. Hormonal secretions are also subject to conditioning.

The third system is formed by the sexual inborn reflexes. The chief receptor end-organs which, on stimulation, evoke the motor and secretory, effects of the sexual response are located in the genitals. The direction of adaptation in human behaviour, through cortical differentiation based on sexual reflexes, can be traced in a composite life-history.

It is commonly observed that infants are capable of rudimentary sexual responses evoked by stimulation of the sexual surfaces, and subthreshold states of activity at the motoneurones must be included too. In the course of bathing, fondling and kissing, the mother becomes of positive sign for the sexual function. However, since it is the custom of most parents to discourage any habits of self-manipulation from developing they soon become of negative sign for sexual activity, for their presence is always linked to an absence of such reflex behaviour. In childhood, therefore, parents tend to become of negative sign, while isolation—which is an environmental stimulus—is positive for the sexual function.

As the child's behaviour widens in scope, inanimate objects such as toys or living things such as domestic pets and playmates in so far as any of these objects accidentally are associated with stimulation of the sexual surfaces, acquire positive effect for the sexual function and take their place alongside isolation as positive factors. The parents and others, who frown and forbid sexual play, however gently, however brutally, are of negative sign.

In growing older there is a definite tendency for the sexes to separate socially, in the home, at play and in school. This means that the possibility of homosexual conditioning is increased. The mild and incidental sexual behaviour characteristic of this age takes place \textit{in the presence} of people of like sex, and does not take place or takes place less often in the presence of people.
of opposite sex. Further, the subject’s own person—a homosexual object—probably acquires a sexual sign through self-manipulation.

Such a homosexual differential system is often succeeded or replaced by one in which persons of the opposite sex are differentiated into two groups—a negative consisting of mother and sister objects for a male or father and brother objects in the case of a female, and a positive group made up of people of the opposite sex who are, in some distinct way, unlike the above negative objects. Subjects, during this stage, may be orientated positively to their "social and intellectual inferiors or superiors," or to those with some age or racial disparity.

Gradually, however, with the unfolding potentialities of developing body and mind and with the moulding influence of social factors, the mature conditioning to the opposite sex assumes the chief importance on the positive side of the differential system. Thus friends of the opposite sex assume potentially a positive effect for sexual function, and ultimately this is differentiated to the wife or husband. Parents, brothers and sisters, teachers, friends of the same or opposite sex, and all inanimate things which have through internal generalization or through actual experience been positive at any time in previous life, tend to become, through non-reinforcement, of negative sign. Environments constituting privacy being usually a precondition to sexual activity in all its stages are usually of positive effect, while public surroundings and company are negative for sexual function.

It will be recognized that, in this "life history" of the mature differential system based upon the sexual reflexes, there rest the seeds of many kinds of perversion—incestuous attachments, fetishism, homosexuality, auto-eroticism, exhibitionism, scoptophilia, etc.—and these seeds grow only with perverted experience on both the positive and negative side of differentiation. The non-reinforcement of the inborn sexual reflexes after the sensorium has been stimulated by a "normal love object" (e.g. in a male subject, a mother or sister, who, having all the attributes of females, are yet of negative sign for the reproductive function) is as important a perverting factor as actual reinforcement of these reflexes after the sensorium has been stimulated by an "abnormal love object." The former perversion by negative conditioning, though just as real, physiologically speaking, as the latter by positive conditioning, is much less obvious. It only results in inhibited behaviour, and not in outwardly expressed behaviour like the latter. Even normality, however, is subject to much variation in the duration and therefore the strength of these developmental differential systems, which may theoretically vary from zero or non-existence to lifelong deviation according to individual experience.

Having built up the mature differential system, however, living conditions still continue to change. The positive object for sexual function may cease to be reinforced by the unconditioned reflex system (from separation by death and by military or economic need or from incompatibilities of various kinds). In this case the positive object undergoes negation, and by a process of mutual induction the hitherto negated objects tend to become positive—the phenomenon commonly termed regression. The mature differential system esta-
blishes itself once more when the positive object which was tending to become negative is again associated with the sexual reflexes when normal living conditions are restored.

In the ultraparadoxical phase reversal of differentiation appears. If all objects that are normally, in the mature adult, of negative effect through differentiation are enumerated—parents, doctors, teachers, brothers, sisters, friends of the same or opposite sex, autoerotic practices, inanimate objects and public surroundings—it is clear that all of these may become of positive moment in a spurious kind of way. The resulting conditioned behaviour is usually observed clinically as "shamelessly erotic." Conversely, objects of positive sign become negative and the subject's behaviour is inadequate sexually. The tendency to the ultraparadoxical phase is shown in the confusion of positive and negative associations appearing clinically as "chaotic sexuality," under which heading Rosanoff (3) actually describes schizophrenia. Phantasies of mixed sexuality are the subjective manifestation of this, and such delusions of changed sexuality like menstruation in a male or amputation of breasts in a female are indications of the sexual disorientation.

3. THE EQUIVALENT AND PARADOXICAL PHASES OF INSTINCTUAL BEHAVIOUR.

In the earlier part of this paper an attempt was made to outline normal differentiation, and to present its tendency to reversal in its schizophrenic or ultraparadoxical phase. The nutritional instinctual reflexes were used to illustrate these processes, and their manifestations in other systems were afterwards dealt with. Attention was, however, drawn to two other phases—the equivalent and the paradoxical. Unlike the reversal that obtains in the ultraparadoxical phase, where negative stimuli evoke positive responses and vice versa, in the paradoxical phase stimuli of large intensity evoke small responses and those of small intensity evoke large responses. In the equivalent phase, stimuli of large and small intensities give equal responses.

If schizophrenia is the clinical manifestation of the cerebral cortex in a pathologically fixed ultraparadoxical state (for the equivalent, paradoxical and ultraparadoxical states of hypnosis normally occur transiently between sleeping and waking), what of the equivalent and paradoxical phases? The former is manifest clinically as melancholia and the latter as mania. Obsessional states, anxiety and hysterical states are the lesser encroachments of whatever pathophysiological processes cause this fixity of the cerebral cortex.

Of course, each element of the cortex as a mosaic of functioning units has its own history and, in consequence, in any cortex there will be evidence of any or all of these hypnotic states existing simultaneously side by side, and this is evident clinically as "mixed states" or "alternating states" described in classical psychiatric works. It is occasionally observed that cases pass through obsessional and anxiety states to melancholia, to mania, and then to schizophrenia. This may be otherwise stated as manifestation in behaviour
of a cortex passing through minor degrees of pathological fixity to the equivalent, paradoxical, and finally to the ultraparadoxical phase.

4. THE PATHOPHYSIOLOGICAL POINT.

The above normal and abnormal orientations based upon the instinctual reflexes are common observations. Another group of observations which is generally accepted as characteristic of the subjects of breakdown requires consideration. This concerns the ambivalence manifested by the injury or killing of some loved object or the flight from it. The pathophysiology of this behaviour is of a different order from that described above.

In an animal suffering from an experimentally induced breakdown, it is possible to identify the source of its difficulty by its behaviour. Thus, such an animal will attempt to flee from the experimental situation (Pavlov (1) and Horsley Gantt (2)), and if forced to remain in its trappings it attempts to bite the pathogenic stimuli (metronome, bell, etc.). The animal is indeed ambivalent towards these stimuli, since it responds to them positively or negatively according to its conditioned experience but, on the other hand, attacks them or avoids them in so far as they disturb normal functioning.

Applying this interpretation to ambivalence in psychiatry, it may be stated that the subject responds positively and negatively to environmental objects according to its experience but, to whatever extent these positive and negative objects are the source of pathogenic conflict, they are attacked or avoided. The fact that so often in mental disorders there is flight from people (running away from home, solitariness, roaming at night and taking to bed during the day, hiding of the face) or aggression towards people (homicidal attacks, quarrelling) is strong evidence that adaptation to persons is the source of difficulty. The subject's interpersonal relationships are ambivalent, because people are of positive or negative sign for instinctual functions on the one hand, and on the other they constitute pathogenic stimuli to the subject so that protection is imperative.

The "generalization" of a pathogenic object whereby ambivalent behaviour initially specific towards one person extends to people in general is a result of dedifferentiation and occurs also in experimental neuroses, where the animal is disturbed not merely by the specific stimulus which caused the breakdown, but by all similar stimuli. Such generalization is a different process from "internal generalization," which was mentioned at the beginning of this paper.

The complete parallel between animal and human disorders may now be outlined. In animals, responses to a pathogenic stimulus are ambivalent, and the character of other responses shows that the cerebral cortex is in an equivalent, paradoxical or ultraparadoxical phase. In human beings behaviour regarding people is ambivalent, and instinctual behaviour conforms to a pattern that is typical of the equivalent, paradoxical, or ultraparadoxical phases. In animals we know that the pathogenic stimulus caused the abnormal phases in the cortex. It may be deduced that in human beings persons have become pathogenic by analogous processes to the above-mentioned experimental stimulus, and so cause neuroses, melancholia, mania and schizophrenia.
G. S.—, aged 40, male.

This patient being intelligent and co-operative, and having insight into his abnormality at its early stages, is a good subject for investigation. The material is given in a question and answer form so that others may judge for themselves the nature of an investigation in terms of neurophysiology. Only a short sample is given, but it was from such investigations (by means of speech) and from observations of actual behaviour clinically that the observed facts forming the substance of this work were collected. The interpretation of the facts as given in the interpolated notes is based on modern concepts of nervous function.

From First Interview.

Q. What was wrong with you at first? A. "I was severely run down by electrical charges." Q. What did these charges do to you? A. "They made me very sick. There is a tightness in your head. They played with various organs later on in C ward." Q. Which organs? A. "Every one bar my heart—they did not tamper with my heart." (Note.—Experimental work shows that a pathophysiological point in the cerebral cortex influences the function of the rest of the cortex in an abnormal fashion. The patient expresses the subjective aspect of this total disorder.)

Excretory system.—Q. You said the charges affected your organs. What effects do they have on the actions of your organs? A. "They can either retard the matter or bring it out with a rush or pleasantly" (i.e. normally, on further questioning.) (Note.—He expresses all degrees of influence on the bowel from positive, through neutral to negative.) Q. That is the bowels of course. Does it affect the urinary bladder? A. "After a great deal of charges there was an extra amount of urine came out and they can make it feel full or empty." Do the charges affect the action of the bladder? A. "They make you feel as if you required to pass urine." Q. Can they stop the bladder from working? A. "Yes, for a little while. Only the determination to get rid of the urine beats the actual waves." (Note.—The influence on the bladder is less marked but recognizable.)

Nutritional system.—Q. You said the charges could make you sick. What other influence do they have on feeding? A. "They can make you feel you want more than you really require. They can tighten your jaws and make you so miserable you do not want to eat. They always ease off and let you have your food." (Note.—This illustrates the tendency of positive food objects to undergo negation in the ultra-paradoxical phase.) Q. When? A. "At the usual hours." (Note.—Summation of a "time" conditioned reflex stimulus may account for this.) Q. What effect did they have on the foods you were not very keen on? A. "As long as they were good [i.e. wholesome, plain, on further questioning] you relished them more. Sometimes they deadened the taste of sweet things like chocolate. Sometimes you had your normal likes and dislikes." (Note.—This is a very interesting statement of his awareness of the paradoxical phase for strong positives, e.g. chocolate becomes weak, and weak positives, e.g. plain food, become strong. He also indicates the fluctuating nature of the abnormal with the normal phases—a phenomenon frequently noted in experimental work.) Q. Did you ever have these charges causing you to eat something you should not eat, e.g. poison or filth? A. "The nearest I got to that was tainted water used in the soup, but it had no ill effects." (Note.—The tendency to the ultraparadoxical phase is illustrated by a mixture of negative with positive signals.) Q. Does it affect saliva? A. "Yes, it can make the saliva flow more than usual or come out suddenly. It never holds it back—only increases it."

Reproductive system.—Q. What effect do they have on your sex organs? A. "They extract the reproductive fluid." Q. How? A. "They make your penis rigid and extract it slowly or else in a rush." Q. Have you any thoughts when this happens? A. "You only wish they would leave you alone. They pester you." Q. Do they affect your sex? A. "You are always conscious of being masculine." Q. Do they ever try to make you a woman? A. (Smiling) "They have tried that but have not managed. You always feel your own sex." Q. In what way did
they try to make you a woman? A. "They tried to make me believe I had a
womb inside me and they put some pleasant charges down the left side of my
body. They can make you lose your identity just for a moment." Q. And when
you lose your identity, are you without a sex? A. "No. You still have a sex—
your own. They try to make you as Satan, and he is sexless, but you still retain
your feeling of sex." (Note.—The tendency to the sexual disorientation by reversal
is illustrated by "mixed phantasy.")

Pathophysiological point.—Q. Who works this? A. "You get the impression
there are men and women." (Note.—The source of the disorder lies in people.)
Q. Do you want to attack or run away from these charges? A. "You wish they
would leave you alone to your natural life. I tried to hang by the arms from a
tree to break the current, but it was just the same—it kept contact. I went bus
runs to see if distance would break it. I stood on a rubber mat too." (Note.—
He attempts to avoid the source of disorder.) Q. It seems to be something you
try to avoid, then? A. "Oh yes. It is not pleasant—your thoughts being listened
to." Q. Have these charges ever caused you to attempt suicide or to do yourself
injury? A. "They have never caused me, but they have given me the feeling,
I should like to hit my head on the corner of a table or something—on a wall—
anything that will hurt. You want to try that but dismiss the idea from your
mind. An inclination to kick someone else to relieve your feelings." (Note.—He,
being a person (even to himself in so far as he sees himself in mirrors, or sees, smells
or touches his own body) is a source of disorder, and so is attacked as others are.
The reversal of locomotor conditioned reflexes is also illustrated since walls and
tables are "to be avoided" but he is "impelled towards them.") Q. Would a
table do? A. "No, It would have to be a living person." (Note.—The specific
need to attack people is shown.) Q. Have you been troubled by them long? A.
"Electrical charges started two days before admission. I was in one job at
23 years and people thought I had lost my identity, and they thought I required
sexual intercourse to get my nervous system into working order. Q. Did you
think they were right? A. "No. I knew positively that they were wrong.
I was very much annoyed with them." Q. Men or women? A. "Both. Women
went through the motions of sexual intercourse to keep me in mind of it and men
spat on the pavement to suggest reproductive fluid." Q. What did this mean?
A. "That I have intercourse with a girl I worked with, whom I admired. She was
eighteen and too young to marry, and was not shy enough. She was too bold."

Locomotor system.—Q. Does it affect your muscles? A. "It can cause cramps
in your thighs, under your chin and fingers."

From Second Interview.

Excretory system.—Q. Did these electrical charges ever cause you to soil your
bed? A. "They used to cause dreams causing emissions." Q. But to soil your
bed with faeces or urine? A. "No, just reproductive fluid." (Note.—There is
no clearly marked ultraparadoxical phase in the excretory system judging by these
answers.)

Pathophysiological point.—Q. Did you want to get away from the people who
caused these charges? A. "Yes." Q. Why? A. "It is very annoying people
listening in to your brain and tampering with your body." Q. How did they
tamper with your body? A. "Playing with the different organs of your body
and muscles." (Note.—I.e., glands and muscles or effector system.) Q. Could
you say exactly what you mean by "playing"? A. "Improve the action or
retard it."

Nutritional system.—Q. Those people used to anno you when you are eating.
Did they want you to think your food was poisoned? A. "No, not poisoned—
just dirty with things off the floor and matter from other people's bodies." Q.
What kind of matter? A. "Bowel matter or other people's saliva." (Note.—
The admixture of negative effects with positive is clearly shown.)

Pathophysiological point.—Q. Did you ever want to attack those people who
caused the charges? A. "Yes, you felt like doing them harm." Q. Do you think
it would have helped your brain to have got them out of the way? A. "Yes, you
would be relieved very much." Q. You told me you had impulses to hurt yourself?
A. "You get the impression that you would be better off with a natural hurt, like

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clawing your face or biting your hand." (Note.—The need to attack persons, including himself, is indicated, and this patient actually injured himself in the above manner.)

Analysis.—Since it is people who are attacked or avoided in this case, the opinion may be stated that the nervous system of this patient functions abnormally because people (in so far as they are conditioned signals which have been combined in some formation which is pathogenic) become the factor constituting a nervous strain. Such signals induce the abnormal phases in the remainder of the cerebral cortex, and evidence of this appears as abnormal behaviour responses. People thus do interfere with his normal functioning, and that he believes this influence to be "electrical" is merely an expression of its power over him, his inability to understand its true nature and his fear of it.

6. Discussion.

It may be truly said that contemporary psychiatry has been stirred by the striking successes in methods of physical treatment. Sargant and Slater (4) express this well in the first sentence of their well-known book—"It is a remarkable fact that, despite the popular notion that psychotherapy is the only method of treatment of psychological conditions, most of the big advances in psychiatric therapy have been along somatic lines." It is significant that they also give a quotation from the Goulstonian Lectures of 1870 given by Henry Maudsley, who surely expresses the beliefs of another generation when psychiatry in this country was undergoing vigorous change—"The observation and classification of mental disorders have been so exclusively psychological that we have not sincerely realized the fact that they illustrate the same pathological principles as other diseases, are produced in the same way, and must be investigated in the same spirit of positive research. Until this is done I see no hope of improvement in our knowledge of them, and no use in multiplying books about them." We, to-day, are indebted to this generation for elevating the care of the mentally ill to an unprecedented level of humanity and efficiency, and for advancing our knowledge of the physiology, anatomy and pathology of the nervous system which elucidated the nature of such mental diseases as are recognized now to be of nutritional, organismal, toxic, endocrinal and traumatic origin.

There is no question of psychiatry finishing up where it began, however, because, side by side with that old and new knowledge of soma there grew up a vast body of collected facts and more or less accepted theory—the product of the parallel development of psychology which to-day comprises many schools. Psychiatry has been greatly enriched by the development of psychology, and has in turn, by its own contributions, repaid its sister science.

From time to time, we feel constrained to take stock of new knowledge of soma and psyche and venture to form new hypotheses on this age-old mind-body problem. The present day is such a time for, with the increasing interest in psychosomatic medicine and the broad biological outlooks that are felt to be necessary for full understanding of the medical sciences, the controversy has been thrust into the fore-ground of the contemporary scene. Monism, dualism, epiphenomenalism, psychophysical parallelism and other workable and unworkable compromises have their protagonists. It appears,
however, that the mind and body have to be one in the meantime—at least, if numbers determine such issues. This decision springs from the countless examples of interconnectedness of mind and body, familiar to all students of humanity. Perhaps our knowledge is inadequate, however, for final decisions. There is still a need for a further parallel development of physical and psychological approaches with profit to both, and if it can be found in what way or ways mind and body are interconnected or are one, a great step forward will have been taken.

The problem of consciousness or mind has been avoided in this paper, which is more concerned with behaviour and the intraneural processes which are believed to accompany it. It has been our aim to observe animal and human behaviour in normal and abnormal function and to detect fundamental parallels. These are so striking in our view that it is felt that they demonstrate a certain degree of identity of functions between the nervous systems of animals and of man, especially in the lower instinctual functions.

It is interesting to note the convergence of physiological and psychological views on interpersonal relationships. For example, the stimuli constituting the mother-object in the child’s nervous system and oral stimulation precede both the arousal of the nutritional reflexes and the infantile sexual reflexes. Again, the stages in the development of the sexual differential system are strikingly like accepted systems of psychosexual development. While it would be false to maintain that we are dealing with identical matters, nevertheless, we feel that they are significantly related. In so far as ambivalence to persons manifests itself in behaviour, we again observe similar conduct in animals with induced neuroses. This observation is admittedly a bold one but the implications are interesting, for the isolation of an ambivalent behaviour pattern in taking a clinical history can form the clue to the root cause of the disorder. For example, if the behaviour of a patient shows aggression towards or avoidance of another person (such as parent or spouse) upon whom there is instinctual dependence, then we can say they (as stimuli) are the source of the nervous dysfunction. In this way abnormal behaviour assumes a certain rationality, or at least has utilitarian value for the subject, since it removes the source of trouble (if he destroys or chases people away) or removes him from the trouble (if he avoids people).

These interesting parallels between appearances in clinical psychiatry and experimental pathophysiology have the important implication that a great mass of physiological work which at present is considered rather of the ‘pure science’ category becomes relevant for psychiatry. The known ways of disrupting normal nervous function in animals afford a method of isolating the etiological factors in mental disorders, and the specific knowledge thus acquired suggests a prospect of specific physical methods of treatment which would help to reconcile the divergent schools of psychiatric thought.

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