A SUGGESTED APPROACH TO THE PROBLEMS OF NEURO-PSYCHIATRY.

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IN considering the structure of the central nervous system as the vehicle for the mind, due regard must be paid to the vast amount of psychological knowledge which has been accumulated, and any new theories advanced must at least to some extent be able to explain accepted psychological material in neurological terms.

Many writers have described behaviour in terms of neurological structure, and supported their findings by detailed anatomical descriptions of the brain and physiological functions of nerve-cells. The ideas about to be elaborated in no way conflict with these many and excellent descriptions, but the writer is of the opinion that there is a fundamental lack somewhere. The current descriptions do not give a complete and satisfactory explanation of mental processes as conceived of to-day. The essential difference lies in the fact that the central nervous system is a three-dimensional structure and not a two-dimensional one* as is so commonly assumed; it is something that has developed during the lifetime of the individual, and this is the fact makes that it so essentially three-dimensional.

The central nervous system of the child at birth is very immature. One writer (Berry, *Mind and Body*) goes so far as to say that for the first six months the baby is little more than an unconscious reflex being. This judgment seems to be the result of conclusions drawn from the too rigid application of knowledge about the central nervous system, with too little regard for actual observation of the subject. In this paper, a consciousness will be postulated as a result of neural activity in the highest functioning centres of the central nervous system. This postulate will allow the newborn baby a "consciousness", but one which would be unrecognizable to the adult. Function cannot precede structure, though demand for function may hasten completion of structure.

In addition to a working knowledge of the adult central nervous system, there must be added the knowledge of the development of this system and the

* The expression "two dimensional" is *not* to be regarded in its strict geometrical sense, but rather as indicating the conception of a single plane with regard to neurological structure on the one hand and the time factor on the other.

Pavlov, in his description of conditioned reflexes and their application to psychopathology, definitely stresses the processes as taking place in the same functional plane, but he does in some of his more recent writings, differentiate the cortical layers. On the other hand there are various schools of psychology which regard "the present" as the most important factor.

approximate ages at which the different levels are structurally able to function. Unfortunately, a precise knowledge of this subject is not yet available. However, an amount of knowledge sufficient for the purposes of this paper can be gleaned from a study of human and comparative embryology and a survey of the work that has been done since the days of Flechsig on the myelination of nerves.

During the first two weeks of fœtal life the neural plate becomes differentiated. At the third week the cranial portion of the neural tube and the three primary vesicles make themselves apparent. By the end of the first month the primary neurons forming the peripheral nerves are laid down and the plexuses roughly indicated; centrally the nerve-roots can be traced into the structure of the walls of the neural tube, where the nuclei for the motor roots can be outlined, the sensory nerves can be recognized as forming definite longitudinal fibre bundles. The higher neurone systems are still in a very rudimentary state. This period of development corresponds to the rudimentary nervous system, in which is found only the apparatus for simple cerebro-spinal reflexes—the system of primary neurones.

During the second month the thalamus is differentiated, and there is a definite laying down of thalamic tracts, the most prominent being those connecting the thalamus with the red nucleus and the approximation of the optic and acoustic fibres, also fibres extending into the corpus striatum forming the thalamic radiation. The walls of the hemispheres are thin and undifferentiated.

At the end of the fifth month the relations of the thalamus and corpus striatum are practically the same as in the adult. The form of the internal capsule can be clearly made out; it contains (*a*) fibres connecting the thalamus with the corpus striatum and the cortex; (*b*) optic and acoustic fibres from the thalamus to the cortex and the rudimentary pyramidal tract. Nevertheless, it is not until between the sixth and seventh months that the cortex approximates to the normal adult stage, with differentiation of the cortical cells into their distinct layers, corresponding to the stratification of the adult cortex. In the primary projection areas at the time of birth the infragranular layer has attained about 80% of its adult thickness and the granular layer 70–75%, whereas the supragranular and molecular layers have attained less than 50%. The sulci and gyri are at this stage in a very rudimentary condition, the island of Reil being completely exposed. The development of the Sylvian fissure is not complete until after birth. The temporal and fronto-parietal opercula are formed first, the frontal and orbital being very late in development. This corresponds to the functional activity of the frontal lobes, which is the last to be acquired. At birth the brain has only attained about 25% of its total adult volume. This general outline of development emphasizes the late appearance of the neopallial structure in contrast to that of the palæencephalon.

The final phase in the development of the nervous system is the myelination of the nerve-fibres. This begins in the central nervous system at about the

fourth or fifth month of fœtal life, and is complete by about the age of 17 or 18. (Some authorities post-date this considerably.) The posterior longitudinal bundle, which is the first tract to be laid down, shows signs of myelination between the fourteenth and sixteenth weeks of fœtal life. By the sixth month there is considerable myelination in the cervical portion of the spinal cord. The central and dorsal roots are well myelinated; the ventral commissural fibres stain lightly and the intersegmental fibres are acquiring myelin sheaths. All the cranial nerves except I and II are well myelinated. There are some tracts which have medullated as far as the midbrain, but anterior to this there is no evidence of myelination. By the seventh month there is still no evidence of myelination anterior to the midbrain; it is limited to structures in the midbrain, medulla and cord. In the cord, reflex arcs are myelinated. All pathways concerned with the fundamental activities of the fœtus are myelinated, and from a neurological aspect the fœtus is able to undertake a separate existence.

By the eighth month there is definite myelination anterior to the midbrain. Fibres connected with the corpus striatum are the first to myelinate. The fibres dividing the globus pallidus are starting to myelinate. The subthalamic nucleus is also showing some myelination of fibres, and myelinated fibres from this nucleus cross the internal capsule. As yet, however, the thalamic region is almost entirely non-medullated. The medial lemniscus fibres into the caudal portion of the thalamus are myelinated, and the spino-thalamic are commencing myelination. There is further medullation of the segmental and intersegmental pathways, and also in the cerebellum and corpus striatum.

At birth the optic nerve begins to myelinate. The medial lemniscus is myelinated to the ventro-lateral nucleus of the thalamus, and fibres from these cells are myelinating as far as the cerebral cortex. A few acoustic fibres have myelinated to the level of the acoustic geniculate. The tectospinal tract is not completely myelinated at its connections with the optic colliculus. The rubrospinal fibres have only a faint myelin sheath in the brain-stem. The corpus restiforme carries myelinated spino-cerebellar fibres of Flechsig's tract from the cells of the posterior column nuclei, and a few olivo-cerebellar fibres to the cerebellum. No pontine or cerebellar cortical fibres are myelinated. Fibres reaching the red nucleus through the cerebellar peduncle (brachium conjunctivum) form a medullated capsule on the caudal and ventral aspects of the red nucleus. A few fibres from the globus pallidus to the red nucleus are myelinated.

In the thalamus, myelination occurs in the lateral nucleus and optic geniculate body. A ventral projection system of fibres extends from this ventro-lateral nucleus to the posterior and anterior gyri of the cerebral cortex —the first cortical projection fibres to myelinate. In the cord there is a uniform increase of myelination. In the rubro-spinal tract, however, it is very faint, and in the pyramidal tract there is none at all.

In the infant of two months the olfactory tracts show the first signs of myelination, and faintly myelinated fibres are found in the secondary olfactory centres and the base of the fore-brain, and also in the tracts in the septum pellucidum, and over the surface of the corpus callosum. The stria medullaris and stria semilunaris are myelinating, as also are the mammillary bodies and the mammillothalamic tract. The optic nerves, chiasma and tracts are almost completely myelinated, as also is the optic geniculate, but the fibres that go on through the internal capsule to the cortex are only faintly myelinated. The pulvinar contains no myelinated fibres, but a tract of myelinated fibres connects it with the optic colliculus. The acoustic geniculate contains myelinated fibres, and projection fibres from these cells are myelinated to the internal capsule. In the internal capsule the pyramidal tract is beginning to myelinate, in contrast to the well-myelinated sensory projection fibres in the posterior limb. The temporo-pontine fibres are very lightly myelinated, the fronto-pontine not at all. The thalamo-olivary fibres are beginning to myelinate, and so also are fibres from the lateral olives via the restiform body to the cerebellar hemispheres. The cerebellar cortex shows marked signs of myelination.

The anterior nucleus of the thalamus has no medullated fibres in its substance. The myelinated fibres of the stria medullaris cover its ventral surface. The medial nucleus contains no evidence of myelination. The ventral nucleus, however, is well myelinated. The myelinated fibres of the spinothalamic tract—the medial lemniscus and brachium conjunctivum—end in the ventral nucleus, which also gives rise to medullated projection fibres extending to the internal capsule. In the cord at the cervical level, the pyramidal and rubrospinal tracts show some myelination. Except for the direct pyramidal tract, the remaining tracts are more or less myelinated.

It will be seen that by the second month of life the four primary sensory-motor fields of the cerebral cortex—the olfactory, visual, acoustic and sensory-cutaneous—are receiving their myelin sheaths. Pathways myelinate in the order in which they develop phylogenetically. Flechsig has shown that in the developing human the process of myelination follows a definite pattern, which has been confirmed by Tilney and Casamajor on kittens, and again by Langworthy on opossums, kittens and humans. The observations of these and other workers seem to point to a very close inter-relationship between myelination and nerve-function, but which of these takes precedence is not definitely known.

In the spinal cord the process begins in the cervical region. The motor roots myelinate before the sensory, then the association fibres within the segment. The intersegmental fibres follow next, then the commissural, and after these the long pathways. Child evolved the theory of axial gradients, and postulated that the axial organs are dominant in initiating and controlling the activity of the whole. This view has been confirmed by other

workers in the field of embryology. It would coincide with the foregoing account of myelination. Tilney and Casamajor's work clearly shows how, in kittens, at birth, the formatio reticularis of the mesencephalon is the highest correlation centre, that myelination of the caudal end of the cord is very incomplete, and that myelination proceeds both cephalad and caudad, the head end (the more recent) always being dominant in controlling the earlier centres. Langworthy notes that material from the medulla of the 8-month fœtus is excellent for demonstrating the pathways, and particularly to show that the brain-stem is built on a segmental basis with large correlation centres superimposed on this fundamental framework.

From the foregoing account the following may be summarized:

1. The segmental nature of the central nervous system.

2. The comparatively late ontogenetic appearance of the cephalad additions to the central nervous system.

3. The fact that in the infant at birth the highest level for association and correlation is found in the thalamic region.

Tilney and Casamajor demonstrated in the kitten's first day of life a peculiar paddling motion of its paws in propelling itself towards its mother. From a study of the central nervous system they formed the conclusion that the neurological centre for this motion was in the formatio reticularis in the mesencephalon. After seven days the kitten acquired a definite and co-ordinated or crawling gait commensurate with the more complicated neural mechanism which had now medullated. They also found that the adult cat, on electrical stimulation of this primitive correlation centre (the formatio reticularis), reproduced the same paddle-like paw movements as were noted in the one-day-old kitten. This would indicate that the primitive reaction pattern, which is either innate or laid down at the beginning of life, persists in the central nervous system in its original form, which may be modified and added to by further neurological association centres, or completely repressed, as the situation demands.

Two other examples may be quoted here of how repressed "behaviour patterns" may once more emerge. The spinal cord mass reaction described by Head and Riddoch consists of various reflex movements, which are only elicited when there has been a severance of the spinal cord from the higher centres. The movements obtained represent the primitive motor response to certain adequate stimuli. Head and Holmes (*Brain*, 1911) have shown, in cases where there has been destruction of the sensory cortex, that sensation itself is not lost, and from this finding they argued that the cortex is not essential to the consciousness of sensation, but that this function can be served by the thalamus. Further, they showed that not only the affective quality of sensations but the emotional life itself of the individual is dependent upon the thalamus rather than on cortical function.

The connecting link between this neurological discussion, as it has so far

been, and its counterpart, the psychological aspect, which covers mental processes and subsequent behaviour, was forged by Pavlov. In reviewing his work on the conditioned reflex, Pavlov draws attention to the striking similarity between his own discoveries and those of Sherrington on the integrative action of the nervous system. While it is not necessary to accept Pavlov's work in its entirety, it proves that there is unquestionably a relationship between mental and neurological processes, and that they follow the same fundamental pattern: stimulus (external to the immediate situation, but which may be internal as far as the body is concerned), a correlation centre or sum of correlation centres, and an effort response—motor, glandular, or a further call on correlation centres. Furthermore, relationship will be formed between any two or more points in the same plane of development when they are subjected to simultaneous stimulation (i.e., the principle of the conditioned reflex).

Up to the time of birth, relatively few stimuli will have reached the fœtus, and fewer responses will have been necessary for it to maintain life. Coincident with birth all this is changed. Stimuli fall upon the child both from without and within the organism, and from now on he has to adapt himself to his surroundings in accordance with his potentialities, if he is to survive. It is through the central nervous system that these adjustments are made. The innate reaction patterns enable him to adapt to the changed conditions of life at birth and immediately after. Tilney and Casamajor have demonstrated how the central nervous system of the kitten deals with these changes, and Langworthy has demonstrated the same mechanism in the human fœtus and baby. These early responses may be regarded as adequate reaction patterns which have been evolved during the phylogenetic development of the organism, as a result of its struggle for survival. These ancestral patterns, however, will only avail the child during this early period of life until such time as he has made his own necessary contacts with his environment.

It is through these contacts with the environment that consciousness is developed. Stimuli, both from without and within, fall upon their adequate receptor organs, and the resulting nerve impulses are conducted upwards towards the cerebral cortex—not directly through one continuous tract, but through relays or cell stations which are also correlating nuclei at lower neurological levels. In the adult, consciousness of the stimulus would be postulated only when the resulting nerve impulse had reached the cortex, when the nature of the stimulus had been analysed out by the cell stations through which it has passed, and when the cortical association fibres had linked up this perceived sensation of the individual with his past experience, so that it would be presented to him as a definite localized sensation and as something which has a meaning for him, to which he would be in a position to make a considered adequate response.

In the infant the situation is entirely different, for it has been demonstrated

that the afferent systems of fibres are myelinated to a higher level than the association and correlating fibres. In the event, therefore, of the nerve impulse reaching the cortex, there are no association fibres to link it up with other centres. Consequently, at the cortical level a separate and distinct consciousness will have to be postulated for each sensation which reaches it. Such an assumption will mean that at this moment the infant's whole being will be bounded by this sensation, which will be to him meaningless, timeless, and without location, but loaded with affect. This conclusion is founded on neurological structure, and upon the fact that as yet he has no experience in time and space.

This upper level of consciousness will not be constructive for the child, because it has no means of discharge. The impulses will therefore have to make their associations, and these nerve impulses will then have to be discharged at a lower synaptic level. A second variety of consciousness may be postulated at this lower neurological level, where there are association fibres, for it was shown at birth that sensory fibres have entered the ventrolateral nucleus of the thalamus; the other nuclei of the thalamus are myelinating, and there are connections both with other tracts of the cord and with cranial nerve nuclei, i.e., the highest functioning level at which association can take place. A consciousness at this level for the early period of life would agree with the findings of Head and Holmes (*loc. cit.*) in their remarks about thalamic consciousness and its affective quality. The infant's consciousness will be mainly centred around his feelings, and the association area for this consciousness will then of necessity be largely made up of neural patterns of this type of consciousness. The affective value of thalamic consciousness can therefore now be conceived in terms of functional development.

This affective value of sensation has added an all-important factor for the further consideration of the child's early life. Stimuli which fall upon the child may be roughly divided into two groups—pleasant and unpleasant. The pleasant will only call forth activity, such as desire to retain or seek, when there has been laid down some pattern of experience. The unpleasant will produce reactions of escape, which at first will follow the simple reflex pattern of indiscriminate mass withdrawal, which may culminate in a convulsive fit if the stimuli be of sufficient intensity within the organism, or something from which he cannot escape.

From now on, life will consist of a series of sensations. With the added factor of experience and the developing complexity of the central nervous system, the child will elaborate more and more complex reactions to retain the pleasant and avoid or reject the unpleasant. At first there will be a seeming continuity of environment with sensation and the conscious self. In the baby they are all one and the same.

This conception of early consciousness does not, of course, bear any resemblance to the type of consciousness familiar to the normal adult, and it would

be difficult for any elements of it to be carried over except in the vaguest form of sensation. The differentiation and delineation of his own body can only be achieved by the development of a " perspective " approach, i.e., the simultaneous stimulation of two or more parts of himself with the same interpretative sensation. The neural pattern of this at a conscious association level will contain correlating association fibres connecting these resulting points of neural excitation. Even in the simplest example of this development, i.e., the child feeling himself, the number of neural pathways concerned is very great. The experience involves the many aspects of sensation—motor, kinæsthetic and co-ordinative—and their inter-relating association neurones.

Along with this differentiation will develop the perception of people and things outside himself, and the capacity to enter into a relationship with them. This is a comparatively long and difficult process. For example, the child in relation to his mother during suckling will be entirely " mouth-nipple " conscious, with marked pleasure affect. Under normal conditions, when satisfaction is reached, where the stimuli that initiate the suckling are reduced to a minimum and when no other stimuli are present, consciousness will be reduced to a minimum and the child will then fall asleep. He will remain in that state until consciousness is again brought into being by stimuli, either from within or without, which break through the threshold that has been established early for those stimuli which demand attention. The nipple that comes and goes will first seem to him part of himself—an extension of mouth-consciousness. Then, by degrees, it will assume an independent identity, and from that the mother, as an entire person, will gradually emerge.

Now this process manifests the basic meaning of the term " identification ". To be identified with a person is to be that person, not just to be like that person. The idea of unity with the mother will still be persistent, for the transition of consciousness from one functional plane to the next cannot be regarded as taking place abruptly, but only as a gradual process. As the separate personality of the mother emerges, the child will tend to hark back to his former consciousness—the psychic incorporation of her, for as yet he will be more or less unable to part with the " pleasure nipple " and his control of it.

From the elaboration of the neural processes which have allowed him to evolve the psychic picture of himself and his relation to his environment will come stimuli from within the psychic mechanism (as it now may be called), which will furnish another consciousness and tend to make consciousness a continuity. This new factor is memory; the capacity to recall external things and to manipulate them as though they were real objects, i.e., to phantasy, or to form eidetic imagery. This early phantasy life of the infant is a very real imagery. Descriptions of eidetic imagery represent it as being photographic in detail and intensity.

The eidetic image is, in point of time, the more primitive type of image, and corresponds to the undifferentiated unity of sensory experience from which

perception on the one hand and conception on the other are later differentiated; it may be regarded as a phase in the ontogenetic recapitulation of phylogenetic development, and to occupy a point midway between the pure sensation of the after-image and the intellectual memory-image of the adult.

Statistical surveys of school-children give figures from 40% to 60% of optical eidetics up to the age of 15 years, after which they show a rapid decline.

Eidetic imagery would appear to be the result of subcortical activity, as it disappears at the age when it is known that cortical correlation and association have assumed full function; it has also been demonstrated that patients suffering from occipital lobe injuries acquire this same type of perception.

Some authorities assert that eidetic imagery is present in forms of sensation other than visual, such as auditory and olfactory.

In considering these other forms, tactile sensation must not be overlooked in view of the work of Head and Holmes on its affective value after cortical injury. There would appear to be a very close correlation between this "thalamic sensation" and the eidetic perception, both of which have been shown to occur in patients who have suffered injury to the dominant cortical area of the sensation concerned. There must also be a very close correlation between eidetic imagery and Freud's conception of the hallucinatory thinking of the infant.

A further hypothesis for this eidetic imagery may be advanced that the photographic nature of the image may depend upon activity of the occipital lobe cortex, which is, as yet, not completely integrated at the cortical level with other association centres. This would give the "meaningless upper level consciousness of sensation", which could be re-projected in the manner of an after-image, and intellectually appreciated by the subcortical visual centres which are integrated in the lower level of consciousness. In accordance with this theory, extensive bilateral injury to the visual area would destroy the capacity for eidetic imagery, while injury to the visual psychic area would tend to produce it.

The individual difference of eidetic intensity in people may be regarded as physiological in origin, and producing psychological differences amounting to character traits.

Another complication is added in the differentiation of phantasy and reality. The pleasant affective value of reality will be taken over at first by the phantasy object, but soon the phantasy picture of reality may be toned "unpleasant" by a heaping of physical tension—which is not, of course, satisfied by the phantasy object. In the absence of the real nipple, the child will produce the phantasy nipple, and an increased feeling of hunger will produce an unpleasant affect in association with the phantasy nipple, which has not yet been differentiated from the real nipple. The relation of cause and effect will not yet, of course, have been worked out in the child's mind. This situation satisfies Pavlov's conception of anxiety, for a positive and negative reaction

are conditioned to a stimulus with a differential threshold which is difficult or impossible to determine. It may provide another explanation of the factor of " frustration ", which thus appears to depend upon the child's capacity for this eidetic imagery, and the number of repetitions which will be necessary before he can in some way elaborate the capacity to distinguish his phantasy from reality. The important thing to remember is that all these newly-acquired potentialities are dependent upon new levels of associations, the fibres, tracts and centres becoming active and representing a constant raising of the postulated neurological level of consciousness, and not upon any actual change in the older neural patterns laid down. The older patterns of value are integrated into the new and those of no value are left (Tilney and Casamajor's work on kittens).

The next thing to be considered, then, is the fate of the older levels of consciousness—the more primitive (caudad) association levels.

The segmental nature of the central nervous system has already been demonstrated, and the way in which the more cephalad additions dominate the lower segmental levels, so that each additional level of correlation centres as they become functional will control that upon which they are superimposed, and connecting links will be formed, bringing up to the new level those neural patterns which are valid. Here, again, the affective value of these neural patterns will be of paramount importance, for those associated with the " pleasant " will, of necessity, be things from which consciousness will not be divorced; while those associated with the " unpleasant " will tend to be " isolated ". Pursuing this theory of axial gradients, another factor emerges. The most cephalad levels are those cortical terminations of the primary sensory projection areas, and these are the connecting links between the organism and the environment from which consciousness emanates. Inhibition, therefore, may be related to things external with consciousness as its vehicle, functioning in a caudad direction; it is therefore a potentially functioning force, even when the child is *in utero*.

Two factors now emerge as controlling, or inhibiting integration—"outside" realities and " inside " phantasies—where the affective value is unpleasant, and is not acceptable to the newer conscious level.

Primitive " pleasures " will in course of development be unpleasantly toned by the intervention of (1) external prohibitions and disapprovals, and (2) interaction and phantasy formation leading to an internal prohibition also. If there is not an adequate source of " pleasure " developed at a higher level of consciousness, then an isolated primitive pleasure-seeking " nucleus " will be formed, isolated only, however, in the upward direction of the three-dimensional psychic structure in course of erection.

The early mental processes of the child consist in the building-up of conceptions of people and things as wholes from the diffuse perceptions of stimuli which reach him. At first the " combinations " will be simple and concrete,

and gradually they will become more complex and abstract. Should any group of constellations of stimuli become markedly toned with " unpleasant affect " in the early formative stages of the simple combinations they will become inhibited, and even when relearned the original inhibition will still be active, so that the primitive units will be less mobile, and will not be able to be handled freely in the building up of the more complex.*

In the normal development there will be, first, the consciousness of the individual sensory areas of an inchoate nature, then an early integration of these sensory impressions into images and forms, simple at first in outline, which can be easily mobilized and built up into the more complex. The seeing and sensing of constellation patterns and the ability to associate in wholes are not present at first. There is, at first, the registration of sensations, and consciousness, as we know it, comes with the grouping of these, with meaning, into patterns, and with this comes insight. At first these patterns are simple, but in proportion to experience they become more complex. The degree of intelligence consists in the extent to which the relationship can be seen, and in the mobility of the smaller units of sensory patterns that can be freely manipulated to fit the exigencies of the moment.

There must be a perfect freedom of movement through the developmental planes and an integrity between them, a complete linking-up and a changing of the forms of consciousness with this development that is unimpaired and continuous throughout the whole.

Intelligence can be definitely equated with freedom of movement and the mobility of the most primitive sensory impressions as well as integrated material which can be integrated, disintegrated and re-synthesized to meet the demands of external reality or internal phantasy.

In cases where the early sensory impressions have been toned with " unpleasantness " they will be subject to repression, which will hinder this mobility, or may even lead to a complete severance of the direct continuity with the developing layer of consciousness. If this conception of intelligence be accepted, then it will be clear that there need be no correlation between size of brain, number of cortical cells, etc., and capacity for mental functioning; one function of the neopallium has been seen to be inhibition, and if in the infant there be developed any affective need for profound inhibition, the subsequent neural development may take on this property and the cortex assume normal proportions though the clinical result might amount to idiocy.

Having now briefly considered the neurological structure of the mental apparatus, the basic principles of therapy may be examined, i.e., the way in

* An example of this nature may be quoted of a child who could not do arithmetic. On investigation it was found that she had associated the numerals with " good " and " bad " fairies, so that she was compelled to avoid the use of the " bad " numerals and compelled to use the " good " ones.

This example shows how emotionally-toned units interfere with their free use, but the conception in the text of the " primitive units " is something very much less complex than the abstract idea of a numeral.

which certain groups of conditioned reflexes or engrams may be unconditioned or reconditioned.

It is assumed that the reader is conversant with the generally-accepted principles of psychotherapy, and the discussion which follows will be the application of the foregoing theory to those principles, and not the elucidation of a new theory; accordingly the discussion is brief.

The nature of the factual material and " content " is purposely omitted from this discussion, and so is the source of energy, to control which the " mental apparatus " has been phylogenetically evolved. Freud regards the source of energy as originating in the depths of the unconscious material, while other writers, such as Kretschmer, regard it as a somatic striving in which the endocrine glands and vegetative nervous system play an important rôle. Here, again, it is only a question of somatic levels whether sources of energy be postulated within the cell itself or its secretion, or carried on a step further to link between the vegetative nervous system and hormones, or still higher to the lowest levels of the central nervous system. In the same way the instinct of self-preservation may be regarded as " somatic " in the healing of a wound, or " psychic " in the flight from danger.

Results in therapy are obtained by widely different methods. There must be, therefore, a common factor which is utilized in changing in some way the internal disposition or integration of the constellation of patterns (engrams), as described on p. 327, and bringing about either a redistribution of inhibition or a lessening of it, or possibly a further increase of inhibition. In fact, the various schools might be classified according to their aim in dealing with this factor. From what has been said it will be manifest that it is upon the factor of inhibition that " engrams " of strongly emotional tone have been " encapsulated ", and by this isolation the further experience of the individual has been unable to recondition their emotional tone.

The essential thing that happens when a patient comes for treatment is that he enters into a relationship with the therapist, and it is the manipulation of this relationship that brings about some internal change in the patient's " mental apparatus ", and thereby effects a change in his capacity for adaptation.

The relationship situation is of paramount importance, for the conditioning of these inhibited " engrams " took place in a " relationship situation ", i.e., the consciousness of the child in relation to the reality or phantasy of some person, and owing to the strong affective value or emotional tone of this experience, the then functioning consciousness was unable to integrate the experience, and accordingly it was inhibited or repressed, or the memory of it was inhibited by the later consciousness. In this relationship, where the patient looks to the therapist for help, there will be a recapitulation of such former situations where the child looked to his parents, or other authority, for help, and this new relationship will be toned accordingly.

As has been previously discussed in the formation of consciousness, the patient will project part of his consciousness on to the therapist—i.e., part of the patient's consciousness and the " ideal " image of the therapist will become fused ; he has handed something of his consciousness over to the therapist. This part of consciousness which he has handed over is not conscious to him, i.e., he is not necessarily actually aware that any change has occurred within his psychic mechanism, and if he were he would be unable to describe it. This part of consciousness may be regarded as its " under side ", that which is inhibiting or controlling the lower layers, and yet which, as was demonstrated, is reinforced in its inhibitory power by direct association with external factors via the projection fibres of the central nervous system, and the way in which the therapist deals with this material will designate the school to which he belongs. There are three possibilities :

(1) Suggestion in simple form, including hypnosis. In this he will form a still further inhibitory alliance with this " consciousness " of the patient and reinforce inhibition, which reinforcement will still more encapsulate the emotionally-toned engrams and their collateral connections, and the symptoms may at least temporarily disappear.

(2) Suggestion, re-education, explanatory forms of treatment, etc., where the therapist maintains an uncritical rôle of authority towards the patient. This alliance will now not be of an inhibitory nature, but more of a condoning acceptance of things (behaviour, attitudes of mind, etc.) as they are, and with this the superficial level of inhibition will be lessened, and a redistribution of forces brought about under the guidance of the therapist, and an outlet found for the hitherto inhibited primitive impulses.

(3) The analytic schools of thought aim at a diminution of inhibition, and this, it would seem, can only be effected by the reconditioning of emotionally-toned engrams, and thus a more complete integration of these " patterns " throughout the neurological layers.

The same relationship situation has to be utilized for this purpose as in the other forms of therapy, but will be manipulated in a different manner. The therapist will become the " total " environment in the relationship situation during the " hour " of treatment, and he will take over that part of the patient's consciousness which is in contact with reality, and with it the " under-side " of consciousness (the inhibiting factor). This will lead to a further temporary splitting of the patient's consciousness while under treatment. Consciousness tending to become a continuity with the therapist, this will bear a close relationship to the child's first efforts to establish an identity of his own when he modelled himself upon the image of his parent—he is the parent. The parents and parent-substitutes were the people through whom he found reality, and were directly and indirectly responsible for his unpleasant feeling tones ; they imposed upon him their standards, which he could not accept without

pain, and they interfered with his pleasures, and he retaliated in phantasy in accordance with his instinctive reactions at the particular level of development which he had reached. These phantasy retaliations were so terrifying and so unacceptable to his " other " consciousness of the " good " parents, that they were immediately inhibited. But these " engrams " persist though isolated, and the feeling tone will pervade consciousness. It is thus clear that again there are laid down antagonistic " conditional reflexes " about one and the same person, but isolated through inhibition, and this will give rise to anxiety. Treatment will now consist in bringing into consciousness the unconscious content of these inhibited engrams, and reconditioning them to reality from the above-stated phantasy content. Through this " relationship " the patient will be able to become " critical " of the therapist—i.e., he has been able to shift part of that self-criticism on to the uncritical therapist; thus from the beginning of therapy a reconditioning is taking place. Through this splitting the patient will be able to observe that part of himself which is projected on to the therapist. The feeling relationship which the patient has for the therapist will be a present-day repetition of some former relationship, but the then conscious factual material will now be unconscious. The therapist will be able from his knowledge of the patient to present to the patient—step by step—the factual material of the inhibited engrams, and with the emergence of this into consciousness again, and the reconditioning of it to reality, the necessity for its continued inhibition will be removed. Two separate processes can be regarded as going on simultaneously during the time of therapy—a lowering of the patient's level of consciousness, and an emergence of isolated engrams at these lower levels through the non-critical attitude and explanations given at the moment of emergence of this material in relation to the therapist.

As treatment progresses, and the early infantile relationship with the parents is freed from emotional content, so the treatment relationship itself will also change. The inner need for the patient to project himself upon the therapist will be diminished, and his consciousness will gradually be a more integrate unity.

This paper has been written with the view of bridging the gulf between neuro-anatomy and psychology, and indicating the possible changes that may occur in the psychic structure of the individual during his lifetime.

The writer feels that only a few theories have been correlated with the ideas advanced and that none of them have been fully expanded or explored, but that a framework has been established upon which a vast amount of work has yet to be done.

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