REMARKS
ON
THE RELATIONS OF DIFFERENT DIVISIONS OF
THE CENTRAL NERVOUS SYSTEM TO
ONE ANOTHER AND TO PARTS
OF THE BODY.
Delivered before the Neurological Society, December 8th, 1897.
BY J. HUGHLINGS JACKSON, M.D., F.R.S.
[After expressing his inability properly to thank the Society
for asking him to deliver this Lecture, and after remarking
on the study of nervous maladies as Dissolutions, Dr. Huglings
Jackson said:]
For the kind of work indicated some scheme of the whole
nervous system is necessary. A morphological one, such as
spinal cord and encephalon, or such as cord, medulla, pons, cerebellum and cerebral hemispheres, will not serve us. We
must have one after degrees of directness and complexity
from which nervous centres, or, as I shall say, Levels, represent
influence from the respiratory or the digestive, or the motor
(ciliary muscles?) to muscles of the perineum (spinnchter aní?)—with the fibres inter-connecting these centres. There are
also Superior Centres of the level itself; for example, there is
the respiratory, medulla, centre, which represents the
scope of the respiratory apparatus; this is represented to
them by intermediation of the laryngeal, phrenic and
costal motor centres of the level. There are, I submit, other
 Superior centres with their subordinate centres, for intes
tinal action, defecation, micturition, the sexual act, parturi
tion, etc.

The Rolandic region of the cortex cerebi and the pre
dorsal lobe are the motor provinces of, respectively, the
middle and highest levels. As to the sensory provinces I
have formerly spoken of the occipital lobes as the highest
sensory centres of the cerebral sub-system, but I now find it
difficult to conclude with any confidence as to what are the
sensory provinces of the middle and highest levels of this
sub-system. In what follows it is to be understood that
the unit of constitution of the whole nervous system (not excluding
the highest level, the so-called "motoric area") is sensori-motor; and also that, in the middle and highest levels at
least, the so-called motor provinces are only chiefly motor and
the sensory provinces only chiefly sensory. I have not
attempted any division of the cerebellum into levels.

I admit that the scheme of three levels is incomplete;
nothing has been said of the sympathetic nervous system,
or of what may be called the olfactory and optic nervous
systems; the retina is developmentally part of the brain
itself, and possibly some elements, or some layer, of the
retina may be the lowest centre of the optic nervous system.

With regard to the lowest level, we have to consider its
Intrinsic and also what I may call its Extrinsic elements. The
intrinsic elements are, as aforesaid, the centres of the cord,
medulla, pons, and aqueduct with their interconnecting
fibres; what I have called Superior centres are also intrinsic
elements of the level. The extrinsic elements are of two
kinds: (1) fibres extrinsic upwards—for instance, those of the
pyramidal tract; and (2) fibres extrinsic downwards—for instance, those of the posterior column. The best illustra
tion of extrinsic elements of the lowest level is given by a
consideration of what Sir William Gowers has called ataxic
paraplegia. The disease in this malady is of fibres of the
cerebellar sub-system, fibres extrinsic upwards, and also of fibres of the posterior column, fibres extrinsic downwards;
these fibres are solidly part of the morphological mass, the
cord, they are not part of the lowest level; they are fibres con
necting centres of that level with centres of the middle level and with parts of the body.

The next question is as to fibres extrinsic upwards connecting
centres of the lowest level with the cerebellum. Connec
tion by sensory fibres is admitted; connection by motor fibres is not generally admitted.

[Attention was then drawn to the very important and
remarkable researches by Sherrington on Reciprocal Innervation and to some recent very valuable researches by Löwenthal.
Löwenthal observed that when the cerebrum (of a dog) was
removed, excitation of a certain part of the cerebellum, acting
when the spinal cord was in tonus, produced relaxation of the
level, and contraction of the body. His experiments show a motor connection, if not a direct one of the cerebellum with anterior horns.]

I have now to restate an old hypothesis on dynamical rela
tions of the two Sub systems by inter-mediation of motor
centres of the motor centres (those of the motor nerves;
and neglecting some parts of the body, the cerebellum represents
movements of the skeletal muscles in the order trunk,
leg, arm, preponderatingly extensor-wise; the cerebrum rep
resents movements of the same muscles in the order arm, leg,
to a much lesser degree, merely a double one, as I suppose, of the impulses from motor centres of the highest levels of each sub
system continuously act upon the motor centres of the lowest
level; that the impulses from each set of higher levels an
tagonise or inhibit one another in different degrees upon
different lowest levels, and so on. It may be supposed that
which the cerebral and the cerebellar impulses antagonise
one another is the same as the order of the degree of their
different representation of movements of muscles of the body.
In accordance with this hypothesis the rigidity in the com
mand to the cerebellum, which is due to the retinal and cerebral influence being taken off the lowest motor centres as the
cerebrum represents movements in the order arm, leg, trunk,
cerebellar influence upon those lowest motor centres is no
longer antagonised; there is cerebellar "influx" into the
cerebrum has abandoned.

It was asserted against this hypothesis that upon complete
transverse lesion of the spinal cord above the lumbar
enlargement—both cerebellar and cerebellar influence being
exterminated the motor centres (those of the motor nerves;
and the legs are rigid and the knee-jerks exaggerated. But a few years ago
Dr. Charlton Bastian brought forward cases showing that upon total transverse lesion of the spinal cord above the
lumbar enlargement the legs are flaccid and the knee-jerks absent, This conclusions are, I think, supported by most
neurologists in this country; they have been confirmed by
Bowlby, Thorburn, and Bruns (of Hanover). I have several
times stated the objections which may be brought against the
theory of cerebral and cerebellar influx, some of which I admit to be valid.

There is another way of considering the hypothesis of
relations of the cerebral and cerebellar sub-systems to one
another by their having the lowest level in common; we may
compare and contrast certain cerebral and certain cerebellar
maladies with one another as being Complementary Inverses
(corresponding opposites). The best marked Complementary
Inverse is a case of extensive cerebellar paralysis (trunk,
legs, arms) and rigidity as the corresponding opposite of the
double hemiplegia (arms, legs, trunk) and rigidity of an
adverse nature from the paresis, the former the latter the
tendency is opisthotonic, in the latter slightly empros
thotic. There is another very important Complementary
Inverse; in some cases of tumour of the middle lobe of the
cerebellum there are tetanus-like seizures. They, being
paroxysmal, are obviously of different nature from the per
sisting cerebellar paralysis with rigidity just mentioned as
certainly as an epileptiform paroxysm (I mean the epilepsy
described by Bravais, 1827) is of different nature from hemipl
geia with rigidity. These tetanus-like seizures depend, I
suppose, on occasional excessive discharges beginning in some
part of the cerebellum; such paroxysms are, speaking
generally, the Complementary Inverse of epileptiform
or epileptic seizures from sudden occasional excessive
discharges beginning in part of the cerebral cortex.
I have not, though that drawing back of the neck was espe
cially a cerebellar symptom. Dr. Buzzard has, however, published
a case of retraction of the head from tumour of one temporo-
sphenoidal lobe. Tetanus-like seizures occur in cases of glioma of the pons. I have pointed out that when there is cerebellar tumour such seizures may be said to be owing to the pressure on the descending centres, which are in the medulla. Those who adopt the pressure hypothesis have, in some cases of tumour of the middle lobe of the cerebellum, three things to account for: (1) cerebellar paralysis, (2) cerebellar paralysis with rigidity, and (3) tetanus-like seizures. All these effects are not very strong, nor are the symptoms as striking as those seen in the conditions mentioned. The important matter as to the relations of the several levels of the cerebrum and sub-system to one another is as to the degree with which the organs of the digestive, circulatory, respiratory, and thermal system are represented by the lowest level and higher levels. I submit that these organs, neglecting their sub-systems, as I consider them, serve in what I call the Medial work of digesting food, circulating blood, and excreting blood, are essentially, are almost solely, represented by the lowest level; but as the manifestations during emotions show they are largely represented in other levels. An illustration may make my meaning clearer; it is unlikely that the heart, to take very arbitrarily but a part of the circulatory apparatus, is represented positively in the higher levels in its character as a machine for circulating the blood (as a blood pump); but it is not likely that the lowest level shall be entirely without all the relations during strong emotions and this means that it is represented in the highest level, that is, in the anatomical substrata of states of consciousness. I will further illustrate by the respiratory system; I confess that I do not think I could make any definite assertion concerning them apart from the respiratory apparatus: 1. There is respiration proper, organic duty, or mechanical work. 2. I recall the operations, as in drawing in the breath when told and whilst (fixation of the chest in "effort") lifting a heavy weight with one hand. 3. It is engaged during great emotions. The services 2 and 3 are animal or personal services in which the higher levels are not, I have put, there factors in Regulations during strong emotions and these organs, they are not organic duties or mental work. (In these remarks I ignore the sensory elements necessarily engaged with motor elements in all operations.) I will make some further remarks on the relations between the first, respiratory, and the second, "voluntary" service of the case. I have recorded a case I saw with Mr. Wilkin that of a man who had, as we thought, "latent" pneumonia (knee-jerks absent). The thing I wish to make prominent is that during the patient's inspiration proper the thoracic cage, the intercostal muscles did not act at all (his breathing was solely dia phragmatic) whereas these muscles acted perfectly in the "voluntary" operation, one of higher level initiation, of drawing in his breath when told (so-called "forced inspiration") so to speak. This incident brought me to the patient, the patient recovered, his respiratory movements became normal and his knee-jerks returned. This case seems to me to demonstrate that the two services, 1 and 2, of the case, are of very different origin. It is the only case of the kind I have seen, nor have I heard of any other like it.

One very important thing with regard to my subject is Regulation of the digestive, circulatory and respiratory systems. The first is the level of the lowermost system, the second, the level of the cerebral sub-system; a very important matter with regard to the first division of what I call Lowest Level Fits. In some cases of supervenous, there is delirium; the positive mental symptoms are not directly, but indirectly consequent, I submit, on the action of the functionless highest. Consideration of the action of supervenous blood leads me to my next topic.

The Scale of Fits.—There are, I think, Lowest Level Fits, Middle Level Fits, (the epilepsy described by Bravais in 1827) and Highest Level Fits (so-called idiopathic epilepsy).

I now consider only Lowest level fits and only those of which I think are respiratory; other lowest level fits are pro-

suppose was meant. The late Milner Fothergill said that "gout poison stimulates the intellect in the earlier stages of Bright's disease." I suppose that owing to an excess of nitrogenous products the vasoco-structor centre is highly stimulated in certain cases of Bright's malady, whereby general arterial tension is raised; and since the cerebral arteries have comparatively little muscular tissue (some physiologists consider it demonstrated that these arteries have vasoco-structor nerves) the result will be that the brain gets more blood and thus in the earlier stages of the malady it will be, at least in some ways, in better working order. This state of things is, however, more pleasant than safe and yet a salutary reduction of high tension pressure is not always on the lips of our patients. Schifer's researches on the suprarenal capsules, his showing that an extract of the medulla of some bodies raises arterial tension, is very important in this connection; arterial tension is raised by this extract, by its action on the muscular coats of the arteries. (It is possible that effete nitrogenous products act similarly and not on the vasoco-structor centre as I suggested.)

It will be seen that in speaking of regulation and in particular of the factor chemical stimulus I have not been leaving the middle level of the cerebral sub-system) in dogs; a very important question, too large a one to deal with for these papers, is this: Do venous blood as a "natural stimulant" of the respiratory apparatus, medulla, centre; it stimulates other centres of the lowest level. I have thought that very great supervenosity, as in severe cases of emphysema from bronchitis, annuls the function of the lumbar centres concerned with the knee-jerk. Riesien Russell finds that asphyxia first exaggerates and then causes loss of, the knee-jerks in dogs. As to another level; in asphyxia there is loss of electrical excitability of the Rolandic area of the cortex (motor province of the functionless highest); a very important matter with regard to the first division of what I call Lowest Level Fits. In some cases of supervenous, there is delirium; the positive mental symptoms are not directly, but indirectly consequent, I submit, on the action of the functionless highest. Consideration of the action of supervenous blood leads me to my next topic.

The Scale of Fits.—There are, I think, Lowest Level Fits, Middle Level Fits, (the epilepsy described by Bravais in 1827) and Highest Level Fits (so-called idiopathic epilepsy).
ducible by certain poisons, by camphor and absinthe for example, and I think by some home-made poisons as in uremic fits; there is still another group of lowest level fits analogous to those producible in guinea-pigs by Brown-Séquard's method.

It is certain that there are respiratory fits in some lower vertebrates, or rather, such fits are easily producible by certain poisons, by camphor and absinthe. Discharges, or rather, such fits are easily producible by certain poisons, by camphor and absinthe.

I must here point out that Horsley and Semon think that attacks of laryngismus stridulus are of cortical origin; they have shown that discharge of the laryngeal centre of one-half of the brain will close the glottis; they adduce the existence of carriage of the pyramidal tract from the brain to the respiratory centres, that the trachea, they depend on the same cause; the contractions are not owing, I submit, to cerebral discharges, but to suspension of cerebral influence on anterior horns for the hands and feet—the function of the cortical cells being, I mean in most cases of laryngismus stridulus, lost from a direct cause only.

I have only spoken of respiratory fits in very young children. It is current doctrine that they are very prone to fits, and I have now to consider how it is that they are so, or rather to those I call lowest level fits. The breathing of the infant is diaphragmatic; the pyramidal tract is not fully developed in the head, and Goltmann's nervous intraryngeal arrangements are but little developed in very young animals and so little in the human infant; it is well known that ve some young dog, I observe that the pyramidal tract (a paralyser of the endings of inhibitory vagus fibres in the heart). In the infant up to 1 year of age the respirations are 44; I suppose that this great rate is partly on account of little higher-level inhibition of the respiratory, medulla, and they are in consequence naturally more excitable than in older people. Moreover, the lowest level in the very young, the newborn infant, although the most advanced in development of all three levels of the cerebral sub-system, is incompletely developed.

In all cases of the process of Evolution, the mental and physical constitution of the whole organism, I shall deal only with motor evolution, a very arbitrary proceeding since evolution is sensory. In the newborn, using, however, terms more familiar to medical men than he uses, I think, of course, answerable for them, and I hope that any misinterpretations I may make of his doctrines, or misapplications of any of them, will not be put down to him.

There are four factors in evolution. In the evolutionary ascent there is (1) Increasing Differentiation (greater Complexity), (2) Increasing Specialisation (greater Definiteness), (3) Increasing Integration (greater Width of Representation), and (4) Increasing Co-operation (greater Association).

(1) Differentiation.—There is increasing complexity; greater complexity the higher the level. The lowest motor centres represent all the muscles of the body in very few different movements; the middle motor centres represent (re-present) all the muscles in more numerous different movements; the highest motor centres represent (re-present) all the muscles in most numerous different movements.

(2) Specialisation.—There is increasing definiteness of representation the higher the level. The movements represented by the lowest motor centres are for, comparatively, general ends, those represented by the middle motor centres are for very particular, those represented by the highest motor centres are for most particular ends.

(3) Integration.—There is increasing width of representation by centres, the higher the level. Each of the lowest motor centres represents movements of muscles of some small region of the body; the middle motor centres represent movements of each of the motor centres of the middle level represents movements of muscles of a wider region. Each of the (hypothetical) motor centres of the highest level represents movements of a widest region if not of the whole organism.

I have in an earlier part of this lecture mentioned the Scale of Fits—Lowest, Middle, and Highest Level Fits. I now suggest a comparison and contrast between middle level and highest level fits as depending on discharges of levels of different function—level and fits I call epileptic seizures; they are those described by Bravais in 1827. No one, nowadays, doubts that there is a discharge, or perhaps many would prefer to say "disease," of some part of the so-called motor region (Bolandic region) of the motor nerves of the brain. Epilepsy is the paralyser of the endings of inhibitory vagus fibres in the heart. In the infant up to 1 year of age the respirations are 44; I suppose that this great rate is partly on account of little higher-level inhibition of the respiratory, medulla, and they are in consequence naturally more excitable than in older people. Moreover, the lowest level in the very young, the newborn infant, although the most advanced in development of all three levels of the cerebral sub-system, is incompletely developed.

In all cases of the process of Evolution, the mental and physical constitution of the whole organism, I shall deal only with motor evolution, a very arbitrary proceeding since evolution is sensory. In the newborn, using, however, terms more familiar to medical men than he uses, I think, of course, answerable for them, and I hope that any misinterpretations I may make of his doctrines, or misapplications of any of them, will not be put down to him.

There are four factors in evolution. In the evolutionary ascent there is (1) Increasing Differentiation (greater Complexity), (2) Increasing Specialisation (greater Definiteness), (3) Increasing Integration (greater Width of Representation), and (4) Increasing Co-operation (greater Association).

(1) Differentiation.—There is increasing complexity; greater complexity the higher the level. The lowest motor centres represent all the muscles of the body in very few different movements; the middle motor centres represent (re-present) all the muscles in more numerous different movements; the highest motor centres represent (re-present) all the muscles in most numerous different movements.

(2) Specialisation.—There is increasing definiteness of representation the higher the level. The movements represented by the lowest motor centres are for, comparatively, general ends, those represented by the middle motor centres are for very particular, those represented by the highest motor centres are for most particular ends.

(3) Integration.—There is increasing width of representation by centres, the higher the level. Each of the lowest motor centres represents movements of muscles of some small region of the body; the middle motor centres represent movements of each of the motor centres of the middle level represents movements of muscles of a wider region. Each of the (hypothetical) motor centres of the highest level represents movements of a widest region if not of the whole organism.

I have in an earlier part of this lecture mentioned the Scale of Fits—Lowest, Middle, and Highest Level Fits. I now suggest a comparison and contrast between middle level and highest level fits as depending on discharges of levels of different function—level and fits I call epileptic seizures; they are those described by Bravais in 1827. No one, nowadays, doubts that there is a discharge, or perhaps many would prefer to say "disease," of some part of the so-called motor region (Bolandic region) of the motor nerves of the brain. Epilepsy is the paralyser of the endings of inhibitory vagus fibres in the heart. In the infant up to 1 year of age the respirations are 44; I suppose that this great rate is partly on account of little higher-level inhibition of the respiratory, medulla, and they are in consequence naturally more excitable than in older people. Moreover, the lowest level in the very young, the newborn infant, although the most advanced in development of all three levels of the cerebral sub-system, is incompletely developed.

In all cases of the process of Evolution, the mental and physical constitution of the whole organism, I shall deal only with motor evolution, a very arbitrary proceeding since evolution is sensory. In the newborn, using, however, terms more familiar to medical men than he uses, I think, of course, answerable for them, and I hope that any misinterpretations I may make of his doctrines, or misapplications of any of them, will not be put down to him.

There are four factors in evolution. In the evolutionary ascent there is (1) Increasing Differentiation (greater Complexity), (2) Increasing Specialisation (greater Definiteness), (3) Increasing Integration (greater Width of Representation), and (4) Increasing Co-operation (greater Association).

(1) Differentiation.—There is increasing complexity; greater complexity the higher the level. The lowest motor centres represent all the muscles of the body in very few different movements; the middle motor centres represent (re-present) all the muscles in more numerous different movements; the highest motor centres represent (re-present) all the muscles in most numerous different movements.

(2) Specialisation.—There is increasing definiteness of representation the higher the level. The movements represented by the lowest motor centres are for, comparatively, general ends, those represented by the middle motor centres are for very particular, those represented by the highest motor centres are for most particular ends.

(3) Integration.—There is increasing width of representation by centres, the higher the level. Each of the lowest motor centres represents movements of muscles of some small region of the body; the middle motor centres represent movements of each of the motor centres of the middle level represents movements of muscles of a wider region. Each of the (hypothetical) motor centres of the highest level represents movements of a widest region if not of the whole organism.

I have in an earlier part of this lecture mentioned the Scale of Fits—Lowest, Middle, and Highest Level Fits. I now suggest a comparison and contrast between middle level and highest level fits as depending on discharges of levels of different function—level and fits I call epileptic seizures; they are those described by Bravais in 1827. No one, nowadays, doubts that there is a discharge, or perhaps many would prefer to say "disease," of some part of the so-called motor region (Bolandic region) of the motor nerves of the brain. Epilepsy is the paralyser of the endings of inhibitory vagus fibres in the heart. In the infant up to 1 year of age the respirations are 44; I suppose that this great rate is partly on account of little higher-level inhibition of the respiratory, medulla, and they are in consequence naturally more excitable than in older people. Moreover, the lowest level in the very young, the newborn infant, although the most advanced in development of all three levels of the cerebral sub-system, is incompletely developed.

In all cases of the process of Evolution, the mental and physical constitution of the whole organism, I shall deal only with motor evolution, a very arbitrary proceeding since evolution is sensory. In the newborn, using, however, terms more familiar to medical men than he uses, I think, of course, answerable for them, and I hope that any misinterpretations I may make of his doctrines, or misapplications of any of them, will not be put down to him.

There are four factors in evolution. In the evolutionary ascent there is (1) Increasing Differentiation (greater Complexity), (2) Increasing Specialisation (greater Definiteness), (3) Increasing Integration (greater Width of Representation), and (4) Increasing Co-operation (greater Association).

(1) Differentiation.—There is increasing complexity; greater complexity the higher the level. The lowest motor centres represent all the muscles of the body in very few different movements; the middle motor centres represent (re-present) all the muscles in more numerous different movements; the highest motor centres represent (re-present) all the muscles in most numerous different movements.
form seizure approaches an epileptic fit in character; if so the hypothesis is further supported.

I suppose that in cases of epilepsy and of epileptiform seizures there is a very local discharge-lesion (physiological fulminate) in one half of the brain. I have thought that there are certain differences between those of energy by nerve cells (nerve discharges) and the liberation of energy by nerve cells (nerve discharges) in each kind of fit. With regard to liberations of energy by nervous elements, we have to consider two things or two aspects of one thing—quickness of energy liberated, and the rate of its liberation; the two being factors beside in any case and of the "excessive" nervous discharges of fits. With regard to the convulsion produced partly directly but mainly indirectly by a discharge-lesion, we have to consider the amount of convulsion, the rate of convulsions, and the range of liberations. In two liberations of equal quantities of energy at different rates there is the same momentum or quantity of motion; but the force of the more rapid but shorter liberation of energy will be greater than that of the slower and longer liberation; using an old-fashioned term, the more rapid the discharge the more "intense" is the fit. The more rapid the liberation of energy by a discharge-lesion (primary discharge) the more numerous and greater are the discharges which will be overcame the more numerous, healthy, comparatively stable, elements will be compelled to discharge (secondary discharges); consequently the greater the amount of convulsion, and the wider its range.

In general remarks on Dissolution. Dissolution from disease is rarely, if ever, the exact reverse of evolution. When we consider nervous maladies as Dissolutions we have to bear in mind not only the Dissolution, that which is effected by disease, but the Evolution going on in the undamaged part. The host is diseased and the patient's spirit is out of the body. Dissolution is a process of "death" as I just said, the more tolerable is the Compensation for a destruction-lesion, the more intolerable is high instability, instability far above normal, of an equal number of cells (discharge-lesion). For the higher the level the greater the number of different movements it represents and the greater is the injury of the level (See part of the lecture on the Process of Evolution for qualifications). To take the case of destruction-lesions first; suppose a destruction of so much (1) grey matter of motor centres of the lowest level as would paralyse one arm completely; I submit that a loss of (2) of the "arm centre," a motorcentre, of the middle level, would produce only weakness of the limb, and that (3) a loss of the same quantity of the motor province of the highest level (of any part of it I may say) would produce very little, if any, obvious effect on the limb. The higher the level the greater the Compensation for a destruction-lesion, or, as I just said, the more tolerable is that kind of lesion. It is quite otherwise in the case of discharge-lesions. The highly disorganized cells of a discharge-lesion (or physiological fulminate) remain connected with other (no doubt, in gradually increasing degrees of indirectness, with all other) normal, healthy, comparatively stable, cells of the level of which such a lesion of concern with most of the fit is beyond question owing to secondary discharges (induced by the primary discharge, that of the fulminate) of these normal cells (there is next, of course, discharge of cells of a lower level or of lower levels). The higher the level the more numerous are the normal cells which, upon discharge of the highest centre, are compelled to co-operate in its excess, since the higher the level the more "intricate" it is, the greater the number of inter-connections. (Co-operation in Excess is, so to say, Compensation inverted.)

The motor province of the highest level is not, I have
acknowledged, more, or not much more, voluminous than is the motor province of the middle level. I now consider this matter. Evolution is not an "even process," not one to be properly symbolised by the raising of an expression to a higher power, called Involution in algebra. If I may put it so, increasing evolution in the nervous system may, at least in some cases, be likened to the raising of some parts of an expression to a higher power than other parts of that expression are raised to.

From theoretical considerations will it appear that in man the motor province of the highest level (a division of the "mental centres") represents very many movements of parts of the body which have small muscles (properly small movements) and that it represents comparatively very few movements of other parts hence, generally, it represents most complex movements of the principal muscles, of the muscles of the hands, and of those of the tongue, lips, and palate; these are movements represented (of course, with corresponding sensory elements) in the physical bases of visual and tactual ideas and of words in the highest level ("mental centres").

The main elements of that part of mind which is commonly distinguished as intellect from the other part called emotion or feeling, are Visual and Tactual ideas and Words. In which the central parts of man's mind, and the insane, is carried on in visual ideas; if all visual ideas were cleared out of a man's mind, he would become practically mindless; there will be a very great representation of ocular movements in the highest level. Further, much mention is carried on by Mr. H. H. Several ideas. He pointed out that intelligence in animals is proportionate to the development of the organ; to use his words; "a highly-elaborated apparatus comes to be the uniform accomplishment of superior intelligence"; there will be a great representation of the organs of the hand in the highest level. I suppose no one denies that words serve in all higher thought, in what has been called conceptual thought. I think that the physical bases of the psychic things we call words are as a rule organs of the tongue, lips, and palate; these are highly elaborated parts of the brain, and small muscles; here is some indirect evidence that those parts are much more represented in the highest level than the parts having large muscles.

In this connexion I draw attention to a very interesting paper by Mr. H. Bradley. In an introductory note he remarks Mr. Bradley asks: "Why, when we strive to move in dreams do we not all always move?" Perhaps this accords with the hypothesis that large movements are but little represented in the highest level ("mental centres"). Mr. Bradley makes the interesting remark that dream movements are easier in some dreams; "thus, for example, it is common to move the lips and tongue and fingers" (parts having small muscles). I think we may conclude, taking into account not only the physical bases of visual and tactual ideas and of words, but also the various kinds of thought that the mind may be engaged in, the parts of the brain from which the nerve impulses enter the spinal cord and cerebral cortex, the nerve impulses representing the parts of the body and its movements, is it not possible that the higher levels of the brain are proportionately more represented and to be the seat of the dreams we call "non-factual dreams"? Yes, the dream is the mental phenomenon of the most simple ideas, and if we call these "mental centres" the mental centres which are the physical bases of the dream are the highest in the brain. It is interesting that, according to Weir Mitchell, after amputation of arms the parts of the lost limbs which remain spectrally, or I might say mentally, present to the patients are the terminal parts, hand and foot; the sufferers are, in most cases, unconscious of the part of the phantom hand or foot and the stump, if I may be pardoned the expression, they are not the parts of the brain which correspond to these parts, but they are the parts of the brain which correspond to the movements of the hand and foot in the body.

We now turn to the facts. Mr. Bradley asks: "Why, when we strive to move in dreams do we not always move?" Perhaps this accords with the hypothesis that large movements are but little represented in the highest level ("mental centres"). Mr. Bradley makes the interesting remark that dream movements are easier in some dreams; "thus, for example, it is common to move the lips and tongue and fingers" (parts having small muscles). I think we may conclude, taking into account not only the physical bases of visual and tactual ideas and of words, but also the various kinds of thought that the mind may be engaged in, the parts of the brain from which the nerve impulses enter the spinal cord and cerebral cortex, the nerve impulses representing the parts of the body and its movements, is it not possible that the higher levels of the brain are proportionately more represented and to be the seat of the dreams we call "non-factual dreams"? Yes, the dream is the mental phenomenon of the most simple ideas, and if we call these "mental centres" the mental centres which are the physical bases of the dream are the highest in the brain.

The examination of the soil, then, is the most important part of the work of the physician who wishes to study the habits of the typhoid bacillus. The examination of the soil, then, is the most important part of the work of the physician who wishes to study the habits of the typhoid bacillus.

In the first instance, samples of soil—using the term "soil" in its widest sense—were collected from what I considered the most "probable" of the areas. These were examined by the methods which are detailed later with a view of finding the typhoid bacillus if it were present. Thirty such samples were collected and examined. In not one single instance was B. typhosus found. In many instances parallel control experiments were carried on with duplicate samples to which had been added small quantities of fresh culture of B. typhosus.