I have placed before you is correct, could not possibly be anything but a failure. In other words, the Galilean conception of the universe, since it cannot represent life, cannot possibly represent reality itself, but is only a preliminary and definitely insufficient working hypothesis with regard to reality. This universe is no disorderly spectacle of independent and self-existent things scattered about indiscriminately in infinite space and time. The facts of biology, even taken by themselves, render any such hypothesis impossible.

I chose the subject of this lecture because it seemed to me of the greatest importance at the present time that we should begin to realize more clearly that what we perceive is a matter of interpretation, and depends upon the axioms or working hypotheses which we adopt as consistent with our observations. In the distinction between biology and the physical sciences this fact comes definitely before us. Biological interpretation occupies a position midway between the Galilean interpretation and humanistic or spiritual interpretations. From the thorough-going Galilean standpoint of materialism the spiritual interpretation is mere illusion, and biology as a science independent of the physical sciences is non-existent. But the time has now come for examination of our axioms and a strict inquiry as to how far they are valid and consistent with experience.

In the course of this examination the spiritual interpretation as the supreme interpretation of our universe is coming again to its own, and a fundamental step seems to me to be the inquiry into the difference between the axioms of biology and those of the physical sciences. Had it been the case that the Galilean conceptions of the physical sciences applied to the phenomena of life the difficulties of a spiritual interpretation of our ordinary experience would have been very great. Biological interpretation provides us with a bridge towards psychological or spiritual interpretation.

Biology does not attempt to deal with distinctively psychological phenomena, although in connexion with the physiology of the nervous system it quite legitimately utilizes conscious responses as a mere index of physiological responses, while not attempting to take into account the distinctive characters of conscious responses as such. Hence biology is distinct from psychology. On the other hand, as I have tried to show, the attempts to extend mechanistic conceptions to life have only resulted in proving definitely that the phenomena of life must be interpreted in terms of the distinctive conception of life. For these reasons biology must be regarded as an independent science; and this is the thesis which I set out to establish.

THE LATE RESULTS OF MENINGEAL HAEMORRHAGE OF THE NEWLY BORN.

BY

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Of cases which present themselves in later childhood as examples of infantile cerebral diplegia or paraplegia, dating from birth, what proportion owe their origin to meningeal haemorrhage occurring during or shortly after the moment of birth? It is a question which has often been asked and to which very different answers have been given. Sixty years ago Little,¹ the orthopaedic surgeon, had made up his mind that the majority of the children brought to him with spastic paralysis owed their unfortunate condition to accidents occurring at birth. So impressed was he with the truth and importance of this discovery that, introduced as a guest, he attended a meeting of the Obstetric Society of London and read a paper, thereafter famous, in which he invited the co-operation of his obstetric friends in investigating the origin of these disturbances, with the later results of which he was familiar and which he described graphically and with singular completeness.

The response to his appeal was apparently somewhat disappointing. The discussion which followed was meagre and barren. The distinguished obstetricians present had no knowledge of these unfortunate results of their ministrations. It was not until the year 1885 that a definite investigation

was undertaken by Sarah MacNutt.² In ten infants dying at birth or soon after birth, with symptoms of asphyxia, stupor, paralysis, rigidity, and convulsions, she demonstrated the presence of extensive meningeal haemorrhage below or above the tentorium cerebelli or in both situations. Gowers³ unhesitatingly accepted the views of Little and MacNutt as in accord with his own extensive experience and describes cases with symptoms similar to those of Little under the name "infantile meningeal haemorrhage." Of MacNutt's work he is reported as saying, "It is by far the most valuable contribution to medical science that the profession has yet received from members of her sex."

In 1889 Osler⁴ published his book *The Cerebral Palsies of Children*. He adopts and adduces evidence in favour of the views of Little and Gowers.

"Facts have gradually been accumulated to show that haemorrhage, usually meningeal, is a very frequent condition in children dying shortly after birth of asphyxia or convulsions, and as the birth palsies almost invariably have this history it seems reasonable to conclude that, in the cases which recover and subsequently present signs of motor disturbance, a similar, though less intense, lesion has existed."

In the last few years investigations into the causes of stillbirth have been carried out by numerous workers. In 167 cases examined Holland⁵ found tears of the tentorium in 81 (48 per cent.), and all of these except 6 were accompanied by subdural haemorrhage. There is general agreement that meningeal haemorrhage is by far the most common cause of death in fresh non-macerated fetuses and in infants dying shortly after the conclusion of labour. It is impossible not to conclude, with Osler, that many, and perhaps the larger number, escape with their lives, but suffer permanent damage in varying degree.

There are, however, difficulties in the way of unqualified acceptance of the view that in the numerous cases of cerebral diplegia which present themselves later in life we are encountering the aftermath of this damage at the moment of birth. The interval between the birth and the time when the crippled child is first brought for advice is often long, and it is not always possible to rely upon the mother's memory of the details of labour, if, indeed, these have ever been told her. Moreover, when after this long interval opportunity presents itself for making a *post-mortem* examination, the scarred and atrophied brain shows no evidence of the nature of the original lesion which occurred so long ago, and which has been so long extinct.

Apart from meningeal haemorrhage two other views have been held of the origin of cerebral diplegia dating from birth. There are those who regard the majority of cases as due to infective meningo-encephalitis, intra-natal or neo-natal. Virchow⁶ speaks of "encephalitis interstitialis congenita," Henoch⁷ of "haemorrhagic encephalitis." If we accept this view we must conclude that in general the infants recover, since routine investigations upon infants dying soon after birth show little evidence of encephalitis, but abundant evidence of haemorrhage. Cases which have come under our own notice suggest that trauma and haemorrhage themselves predispose to encephalitis. Probably the organization of the clot is always accompanied by a varying inflammatory reaction. The following is a good example of suppuration supervening upon haemorrhage. In this case there could be no doubt about the existence of the haemorrhage, because in addition to meningeal exudation there was a large clot within the substance of the brain.

An infant born at full time, in St. James's Hospital, Balham, with a breech presentation, after a difficult labour, was to some extent asphyxiated. Seen on the sixth day of life the fontanelle was tense and bulging, the pupils were unequal, and the limbs stiff and rigid. There had been repeated convulsions. On the sixth day the temperature rose to 104° F., and continued high. Death took place on the tenth day. At the autopsy the surface of the brain showed extensive suppurative meningitis as well as effusion of blood under the pia mater. In addition section of the brain showed a very large blood clot occupying a great part of the left hemisphere.

To assess the part played by developmental defect in the production of cerebral paraplegia and diplegia is even more difficult. Collier,⁸ in an important paper, which has clearly influenced much subsequent writing on the subject, is inclined to deny etiological significance to meningeal haemorrhage occurring at birth, and, basing his opinion upon *post-mortem* studies, to lay greater stress upon faults of development. Space will not permit a full discussion of this difficult question. We believe that in general it is true to say that in cases of diplegia due to developmental defect we find that the

whole personality of the child is upon a low plane, that there is little power of auto-education, and that physical defects are constantly associated with the mental defect. The purpose of this paper is to lay stress upon the high degree of mental development which many of these children damaged at birth ultimately achieve, however great the delay in acquiring certain functions may be in infancy and early childhood. The great improvement shown by many cases of birth injury after the first few years of life appears to us to be due, not to the completion of a developmental process which has been subject to a mere delay, but to the final success of a process of self-education which has been achieved by the child's persistence in overcoming difficulties much greater than fall to the lot of the normal infant.

To illustrate the type of case we have in mind the following three histories may be quoted.

Case 1.—A boy of 15, long thought to be grossly mentally defective, though his mother refused to believe it, with spastic gait, stiff and clumsy hands, exaggerated mouthing speech, a vacant expressionless face, and a loud meaningless laugh, has nevertheless two intimate and devoted friends of his own age. He is a great collector of stamps and something of an authority on them. These two friends of his have pushed their way beyond all this unpromising exterior and have found behind it something to repay them.

Case 2.—A girl of 17, who was brought to one of us first at the age of 7, did not walk or speak until she was 4, and was thought to be an idiot. She now speaks fluently though a little monotonously. She walks well on the level but has difficulties with staircases. She writes laboriously, her whole body stiffened with the effort to control the pen. Yet her imaginative powers are so good that she was the author of a little play performed by the girls at her school.

Case 3.—A boy born very prematurely walked with great difficulty and with many falls in his third year. At 4 years old he could only articulate ten words, but from the age of 3 he had fallen into the way of expressing his wants by singing. Thus when he wanted his toy soldiers he hummed clearly and distinctly and in perfect tune the air of the hymn "Onward, Christian soldiers." During all this time the parents were well aware that visitors regarded him as mentally defective. At 6 he began to be able to articulate more clearly and to speak fairly well. It was then discovered how retentive was his memory with regard to what his mother had read to him before he could speak. Asked to name the twelve Apostles he confessed himself beaten, but said, "I can see them walking in the desert. Some of them are in front, some of them are behind, and the one that takes the money is in a taxi." He often refers to this or that as happening "before I could speak." Now at the age of 9 he is still inefficient at certain movements which require control. His handwriting is very bad, and he feeds himself untidily and with difficulty. Yet he does well at school, is far beyond the average in mathematical ability, and has very good general knowledge. He loves games, but is very bad at them.

No one now thinks these children idiotic and imbecile—no one, at least, who judges by more than a glance at the exterior. Yet in early childhood so great was the delay in the education of the sensorimotor paths that such was the opinion in each case. Not all cases, of course, achieve so much, but all show great initial delay and a surprising degree of subsequent improvement.

The Latency of Symptoms during Early Infancy.

With the symptoms which result from the meningeal haemorrhage at the moment of birth we are not at present concerned. Though as a rule sufficiently definite, in the absence of expert examination they may pass unnoticed or their significance may not be appreciated. After recovery from the initial shock of the haemorrhage it is clear that, as a rule, a period of latency follows which lasts for many months. A consideration of the order in which the different parts of the brain are developed explains the length of the interval which usually intervenes between birth, when the damage is sustained, and the time when the child is brought to the doctor and complaint is made of failure to grasp, to sit, to walk, or to speak.

Physiologically the brain of the newborn is active only in part. Its small size and weight (380 grams) is due to the fact that it is composed almost entirely of grey matter. While the cellular elements are complete and are not to be added to during the whole of life, the myelin sheaths which surround the nerve processes of the cells and which give the white appearance to the subcortical layer of the adult brain are developed only in very small part. Only those fibres are medullated which are of immediate and vital importance to the newly born, those which preside over the functions of respiration, circulation, and nutrition, and those which have to do with certain reflex movements such as kicking, or automatic movements such as sucking. On the other hand, the fibres from the frontal, temporal, and occipital lobes, the commissural fibres (connecting the two halves of

the cerebrum) and the projection fibres (connecting the cortex with the lower parts of the central nervous system) are not myelinated until a varying time after birth, and are therefore, so far as we know, incapable of carrying impulses either afferent or efferent. The paths, in other words, which render possible complicated and controlled motor action and equipoise of the body are not developed.

In the normal infant, therefore, at birth and for some time thereafter, the nervous mechanism at work is almost entirely that of the medulla and spinal cord. All movements are reflex in character because the psychomotor centres in the brain are not developed. It follows from this that in early infancy symptoms will result only from lesions which at the time of birth affected the medulla and lower centres, and that the permanent ill effects of lesions which at the time of birth affected the cerebral cortex will appear later. In early infancy the cortical areas, in this sense, may be said to be "a silent area" of the brain.

The medulla, on the contrary, is active from the first, and it is interesting to note that in our series, in every instance in which we were able to recognize diplegia in an infant before the end of the third month, there were present symptoms of damage to the medulla, and that it was for these symptoms that advice was sought. In two cases the chief symptom noted was dysphagia and clumsiness in sucking; in two aphonia; in two stertor, apparently from palatal paresis. One of these last was about to be admitted to the diphtheria ward. In another older child, in whom the stertor had persisted, an operation for removal of adenoids had been undertaken without producing any change. The first case described by MacNutt showed this symptom, which made her "start forward" with the thought of tracheotomy in her mind. The subsequent history of these cases showed that all suffered more or less severely from diplegia. The immediate mortality of cases with subtentorial haemorrhage and medullary injury is probably very high, and explains the rarity with which they are met.

The Ultimate Effect upon the Child's Physical Condition of Meningeal Haemorrhage at Birth.

At birth and for some little time afterwards movement is governed altogether by the older and basic cord innervation. The assumption of cortical control is gradual and can be traced throughout the first year of life. In infants with damage due to meningeal haemorrhage the supremacy of the cortex is delayed or incomplete, so that movements and reflexes characteristic of earliest infancy persist for many years or are permanent.

In mammals experimental ablation of the cortex is said to produce the following results—results which are fleeting and transitory in animals lower in the scale of development, but which are in some degree permanent in the higher apes, although the passage of time brings about very great improvement.

1. A state of rigidity or tonic contraction due to the removal of the inhibitory influences of the higher centres which normally moderate and control the reflexes which determine the muscular tone.

2. An interference with "reciprocal innervation"—that is to say, with the simultaneous relaxation of antagonistic muscles which must accompany voluntary muscular contraction if it is to be effective and precise.

3. A loss of motor power and an imperfect capacity for apprehending the position and form of objects by means of the muscular and cutaneous senses—that is, a psychical paralysis of sensibility and motion.

Such a description applies with equal truth to the state of the normal infant at birth, because of the non-development of the necessary myelin sheath of the nerve processes, and in varying degree to older children whose cortex has been damaged at birth. The muscles of these unfortunates are not powerless. They do not atrophy. They may even, when growth and nutrition is good, hypertrophy. Their failure to grasp, to walk, to speak, is due not to paresis of muscle, but to a disordered innervation which produces simultaneous contraction of antagonistic muscles. With the failure of the cortical control to develop efficiently, the muscular response to the voluntary impulse, though it may be powerful and very widely disseminated, is ill regulated and ineffective. In some cases, on any attempt at performing a voluntary action the unduly diffused nervous impulse provokes a spasm which involves almost all the muscles in the body, gripping the limbs in rigid tonus by the simultaneous contraction of antagonistic muscles.

The area of cortical damage or destruction determines the localization of the muscular defect. In many cases the damage is strictly confined to the uppermost parts of the Rolandic area, where lie the areas for the control of movements of the lower limbs. When the oozing of blood has been more extensive the damage may extend to the arm areas on either side, or finally to the areas for face, lips, and tongue. Although it is the rule rather than the exception to find the damage greater on one side than on the other, and paralysis is therefore present in unequal degree on the two sides, it is quite exceptional to find that one side has completely escaped and that hemiplegia has resulted. In true hemiplegia at birth it is probable that the lesion is within and not upon the surface of the brain. In the mildest cases paraplegia results, and in general cases of diplegia and cases of diplegia combined with pseudo-bulbar paralysis are due to more extensive and more severe injury. To this there are, however, exceptions. In not all the cases is the vertex cerebri the part to feel most severely the effect of the injury. Occasionally we meet with children whose arms are more affected than their legs, and with children in whom marked pseudo-bulbar symptoms are present with minimal symptoms of diplegia. Occasionally we find instead of spasm and hypertonus a very marked amyotonia, although the behaviour of the muscles upon attempted movement and the attitudes and involuntary movements which result are in other respects identical. It is possible that in these cases we have to deal with the results of subtentorial haemorrhage and a similar damage to the cerebellum. With cerebellar damage atonia, asthenia, and ataxia may be added to the picture.

Whatever the extent or distribution of the damage to the limb areas, when the child's body is at rest, nothing abnormal may be noticed. It is only the attempt to perform a voluntary movement which provokes the abnormal postures and spasm. Thus in cases of paraplegia the incapacity is often not apparent until the child is held in the upright position by the shoulders with feet hanging down to touch the ground. Then upon the attempt to walk or stand the legs become rigidly extended and adducted, so that the feet tend to cross in the so-called scissor gait, while the over-extension of the ankle brings the heels off the ground. It is not surprising that a child so affected may not achieve the power of standing for many years, when we consider how greatly the adductor spasm curtails the base upon which the body must be balanced. It is literally as difficult for such a child to walk as for a normal child to balance itself upon a tightrope. Similarly, on attempting to grasp, the child with diplegia finds the arms tend to become extended and adducted, the hands pronated, and the fingers separated and overextended. Once an object is grasped it can often be held firmly, though there may be difficulty again in relaxing the grip. The degree of spasm is very variable, but whether the limbs are held rigid or remain comparatively flexible to passive movement, the postures assumed on attempting voluntary movement are constant.

When the areas for the face, lips, and tongue have been damaged the expressionless face is very characteristic. The constantly changing facial play of the normal child is absent. The paresis is most marked about the lips, which are loose, prominent, and immobile. They are generally unable to retain the saliva, and when the child is held upright, so that saliva no longer gravitates to the back of the mouth, there is apt to be a great deal of dribbling. The reflex movements of sucking and the movements involved in chewing and swallowing are generally carried out sufficiently well to meet all requirements, although close observation of them will often show some slight loss of efficiency. Aerophagy is a common trouble. In a few cases the passage to solid food is only accomplished with great difficulty and after a long time. Speech is always greatly delayed. The complicated muscular movements involved are only learned slowly and with great difficulty. In the end the movements involved are exaggerated and the speech is mouthing and explosive. Dentals and labials present the greatest difficulties. The cry is expressionless and monotonous. It lacks the varying emotional tones which the normal child imparts to it. The laugh similarly is harsh and has no feeling in it. It is not, therefore, surprising that those who do not know the children well, who have no opportunity of recognizing the intelligence which lies hid behind the stiff face, and who judge by the immobile expression, the uncouth attempts at speech, the vacant laugh and unmeaning cry, are apt to consider the children as obviously imbecile or idiotic.

In the group of cases which we have studied and which we regard as examples of the late effects of meningeal haemorrhage occurring during labour, the Wassermann test was always negative, the optic discs were normal except in one case with extensive choroiditis, and developmental abnormalities in other parts of the body were absent. Apart from the microcephaly of slight degree which was present in some of the worst cases, the children, though often small and slim, were in no way deformed or misshapen. The bird-like face and narrow frontal region of true microcephaly were never found. The ears were not misshapen, there was no tendency to obesity. Especially when seen asleep, when the want of facial expression is not apparent, and when the awkward limbs are at rest, the impression conveyed to the eye may be that of health and even of beauty. In many of the cases a disfiguring strabismus develops at some time during early childhood. In infants it appears less common.

The Ultimate Effect upon the Child's Mental Development of Meningeal Haemorrhage Occurring at Birth.

The intellect even of an idiot is in continuous evolution, and the worst cases respond to patient and persistent education by showing improvement. The results achieved by education depend, however, upon the cause of the mental defect. In general least success will be achieved in cases, with or without spasticity, in which there is numerical deficiency, irregular arrangement, and imperfect development of cortical neurons. The greatest success, on the other hand, will follow when the delay in mental development is due to sense deprivation, as in the striking cases of children who are both blind and deaf and who have achieved a high degree of mental culture elaborated from cognitions derived entirely from sensations of touch. In this sense the children whom we are now considering occupy an intermediate position. It is true that the cortical cells have been damaged* yet it would appear that, as a rule, though not perhaps always, the damage is sustained by one part of the cortex only—that which is concerned with the reception of tactile and muscular sensations and with the initiation of voluntary movements—and it is in these respects only that the children are defective. By every avenue which was closed to Helen Keller or to Laura Bridgman, both of whom from a very early age were blind and deaf, impulses freely reach the brain of these children. In due course the majority of them develop a high degree both of visual memory and of auditory word memory. But the one path by which Helen Keller and Laura Bridgman achieved so much is closed to them, or at least gravely obstructed.

It is by the sensations of touch and by muscle sense that the majority of impulses reach the brain during infancy. The baby carries every object to his mouth, that he may subject it to examination by lips and tongue, because they are most plentifully endowed with sensory nerve endings. As the cortex awakens to these repeated stimuli and develops under their influence the powers of the infant grow apace. Gradually the differential perception of stimuli becomes sufficiently advanced to enable the child to recognize the position of its body and limbs and to adjust them at will. It is the failure of the infant with diplegia to develop the power to sit or to grasp that usually first excites apprehension. The gradual change from the stiff spastic movements of the newborn to the freer play and more controlled action of the normal child at the sixth month is too subtle for its absence to be noted. But every mother knows that her baby should sit up before it is much older than six months. Thereafter the normal infant, able at will to adjust its body to space, developing a greater and greater mobility, accumulates knowledge at an ever-increasing rate by refining more and more its tactile, stereognostic, and muscular senses. The diplegic infant, relatively immobilized and anaesthetic, lags far behind. Few stimuli reach the brain, and therefore few elements capable of being utilized for new and more complex mental processes. For long the brain lies fallow. Hence it comes about, as we have almost always noticed, that during the second and perhaps the third years of life the mothers of these children have been intensely depressed by the visible

* It is possible that haemorrhage spreading over the frontal lobes may lead to a greater degree of mental defect, but we have no example of this in our series. We have, however, met with at least one case in which diplegia appears to be combined with amaurosis. It is possible that this is due to involvement of the occipital lobes. The child is under observation, and it may be possible to decide the point later. This child is backward and foolish in behaviour, but at the age of 4 can sing the air of the "Marseillaise" with spirit.

want of progress. On all sides they are assured that the child is grossly mentally defective. It is only their perception that the visual and auditory memory of the child is relatively unimpaired that accounts for their steadfast refusal to believe it. Except in a few of the worst cases with microcephaly, and especially when there have been repeated convulsions, the mothers of these children have throughout maintained that the intelligence is good, and that, although they cannot speak, they understand every word that is said and that their memory is good.

In another way also the diplegic is apt to contrast with the child who is mentally defective. In spastic idiots the attention is weak, and cannot be fixed on anything. They touch many objects one after the other, but show none of that curiosity which is truly attentive. Their actions are inconclusive; they show no joy in the exercise of their powers or patience in practising them. It is striking to watch how differently in these respects the child who suffered from injury at birth may act. More and more he works with us in the attempt to overcome his disability. Though he cannot walk, if he is held upright he works his stiff little limbs with a will, laughing aloud with delight. Little by little, with infinite pains, he learns to grasp, to balance, to walk, and when, years later, he too achieves a degree of mobility and control the improvement is striking. It is just this power of auto-education which is conspicuously lacking in the imbecile or the idiot. In later childhood the progress is often so rapid that the mother, previously so despondent, eagerly expresses her satisfaction, while she is now able to convince others easily enough that the mental powers of the child are considerable.

It is in general only when the sensory and motor loss extends to and involves the hands that the confusion with primary mental defect arises. Those who are only paraplegic walk late and with difficulty, but are not thought to be idiots. They may be excitable and restless, because their helplessness leaves them too long in their mothers' arms, without sufficient outlet for their energies, but of their cleverness there is often no doubt whatever.*

But when the hands, all-important as they are for the auto-education of the infant, are insensitive and paretic, for the time being contact with environment is almost completely lost. Head⁹ has emphasized how extensive is the area of cortex which is devoted to the reception of sensations derived from the opposing surfaces of thumb and index finger. To the precision and complexity of the movements of the human hand, slowly acquired by the race in the course of ages, man owes his preservation and supremacy. And in the early months and years of life the infant, in its striving and progress, must recapitulate the story of its race. If it cannot, if the development of the hand is retarded, the avenue to the brain along which in normal infancy almost all the traffic passes is narrowed and obstructed. When there is added injury to the voluntary centres which control lips and tongue so that speech too is absent, the difficulties are still further increased. For speech is not only a means of expressing thought: speech clarifies thinking.

A long and close study of a group of some thirty of these cases--of all ages from earliest infancy to adolescence--has convinced us that they differ unmistakably from cases of primary mental defect with spasticity due to developmental causes. In a few frequent and persistent epileptiform convulsions have played havoc with the intelligence. After each convulsion the consequent deterioration in energy and achievement may be appreciable. But if convulsions are not present the defect commonly remains limited to a loss of voluntary movement and of sensation, involving a greater or a less extent of the body. The resulting retardation in development is most apparent in the first years of life, because

education at that age proceeds by the refinement and analysis of sensation. The auditory and visual paths then are relatively unimportant. Gradually, by constant effort and with a success which varies with the extent of the original lesion, the child achieves in whole or in part that control of movement which comes so easily to the normal infant. From an early stage, however, those who know the children well can appreciate that despite the spastic limbs, the immobile face, or incoherent speech, the intelligence of the child is alert. Observation, memory, concentration of purpose, affection, intuition, and reasoning may be on a comparatively high level. No doubt the children are apt to be nervous and unstable. Like some caged animal, cut off from the stimulus of environment, they are apt to show strange traits--to have a capricious or unnatural appetite, to sleep badly, or to be unduly timid. These are drawbacks often perhaps inevitable, but with sheer mental defect they have nothing to do. In general it may be said that the response shown by these children to suitable education is remarkable. For them the methods elaborated by Dr. Montessori are especially applicable, and may give the happiest results. In later childhood, even when the voluntary movements remain very inco-ordinate, the mental powers may finally attain a very considerable development.

Conclusions.

1. Among cases of infantile diplegia or paraplegia it is possible to recognize a group in which the defect is confined to the sensorimotor cortical areas.
2. Probably all cases in this group are due to birth injury, although all cases of birth injury may not belong to the group.
3. Since education at first proceeds almost entirely by sensorimotor paths there is in early childhood a deceptive appearance of gross mental defect.
4. In later childhood progress may be rapid and recovery almost complete. The difficulty is overcome by the remarkable persistence in effort which is characteristic of most of these children. Even when voluntary movements remain stiff and awkward the child may be a quick learner by eye and ear. Inco-ordination may remain though character and intelligence may be on a high plane.

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THE MODIFICATION OF GASTRIC FUNCTION BY MEANS OF DRUGS.*

BY

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EVERYONE engaged in the practice of medicine is aware of the gulf separating the beliefs of the physician actively occupied in treating diseases and their symptoms, from the knowledge, precise but meagre, of the experimental pharmacologist. Whereas human hope and optimism have during many ages collected a series of remedies, often of unknown or varying composition, which may do good, the critical scientist, meticulously rejecting everything incapable of objective proof, has been unable to point to more than a very few substances which have definite organic actions, and has been obliged to condemn, as apparently inactive, large numbers of those agents which had previously been held to be of curative value.

In no branch of medicine is this contrast more apparent than in that which deals with disorders of the stomach; for medical writers, from the earliest times, have given enormous lists of remedies for such conditions, but it is with difficulty that the student can find, in any modern textbook of pharmacology, reference to drugs which can in any way modify gastric function. There has, indeed, until recent

* A paper read before the Section of Therapeutics and Pharmacology, Royal Society of Medicine, October, 1922. The expenses incurred in connexion with the researches have been partially defrayed by a Government grant made through the Royal Society.

* It is very probable that Lord Byron's lameness was due to paraplegia as a result of a birth injury. Whatever its nature, it is clear at least that it was not due to a "club-foot." The lasts on which his boots were made are piously preserved in the Nottingham Museum, and they are symmetrical and well shaped. Mr. John Murray, of Albemarle Street, has been good enough to show me two surgical boots made for Byron as a boy. They show a long and slender foot. By a contemporary writer the poet is described as entering a room with a curious running movement, "running rather than walking." Again, "He moved with a peculiar sliding gait . . . in fact, with the gait of a person walking on the balls and toes of his feet." It is clear that the disability was much greater in early childhood, and was overcome to a considerable extent as he grew older. As a child he was taken to John Hunter, to Dr. Baillie, and many other doctors. Later he played cricket for Harrow, though with someone to run for him, and was a great swimmer. In other respects he was almost as well endowed: physically as mentally, of great strength and of amazing personal beauty. Again and again he refers to his lameness as caused by his mother's "false modesty at his birth." He suffered from repeated epileptiform convulsions.