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Consideration of the Relationship of Primary and Secondary Mental Deficiencies, Convulsive Disorders, Avitaminosis, and Alteration of Electro-neuronal Potential. *Cook, G. H.* 166
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Heredity in the Functional Psychoses.

To date four methods have been devised for the study of heredity. The first is Galton's family history method. Several generations of clinical experience have shown that this method is fallacious because mere observation alone cannot differentiate hereditary from environmental causes. On the basis of their fallacious statistical studies, the Galtonians have come to incorrect conclusions, such as the inheritability of rickets, tuberculosis and pellagra. It is evident that the mere recurrence of a certain trait in the same family does not prove that trait to be hereditary. This follows automatically from the fact that members of the same family have similar environments. Unfortunately, this obsolete family history method is often used to-day. The second method was introduced by Mendel. This is a purely experimental technique which necessitates pure stock for the parent generation, a completely controlled environment, inbreeding of brother and sister and a sufficiently large number of F2 progeny to bring out the characteristic Mendelian ratio. Only by the experimental demonstration of the F2 ratio can this method prove a character to be hereditary. For functional psychoses none of the conditions necessary for a Mendelian experiment can be achieved in human beings. The method, therefore, can give us no information as to whether or not these psychoses are inherited. The third method widely used for the study of heredity in mental diseases is the combination method. This method seeks to find the characteristic F2 Mendelian ratios in family histories. We have seen that these ratios appear only in certain stages of a very highly specialized experimental technique. Occasionally a characteristic ratio can be found in simple 1-gene diseases like Huntington's chorea and polydactyly. It is a grave error to reason from this analogy that the discovery of a characteristic ratio in a few families necessarily proves the character to be hereditary. A casual inspection of family histories of mental patients shows that no such simple mechanism could possibly be involved. Goddard's classical error of trying to prove feeblemindedness to be hereditary by this method is a typical example of the uselessness of the method for psychiatric disorders. The fourth method is the study of the mental status of twins. Although the heredity is the same in identical twins, the mere discovery of two twins with the same mental disorder does not prove the mental disorder to be hereditary. Since twins are more likely to have similar environments than are ordinary individuals, similarities in environment seem to be the cause of such simultaneous appearance of functional psychoses. If heredity were the cause of the psychosis, it would be impossible for only one twin to be affected. In Rosanoff's study of 41 pairs of identical twins, only one twin was affected in 32 per cent. of the pairs. This is substantial evidence against a hereditary etiology of schizophrenia. The other three groups of cases summarized are ordinary siblings. They have identical hereditary relationships. The declining double schizophrenia rate in these three groups (20 per cent., 10 per cent., 3 per cent.) must be due to environmental difference.

(Author's abstr.)

Electroencephalographic Studies Immediately Following Head Injury.

1. If mild cerebral trauma such as we were investigating produced changes in the electroencephalographic tracing, the abnormality disappeared within a period of minutes in the vast majority of cases.

2. Patients who gave a history of amnesia following cerebral trauma, but were clear mentally at the time the EEG was taken, showed only slight increase in the percentage of abnormal records as compared to the control series. This was true even when the records were taken within a few hours of the accident.

3. If there was an impairment of consciousness of any degree at the time the EEG was taken, abnormality in the EEG was the rule.

4. Electroencephalographic records taken within 30 minutes after patients sustained head injury showed a greater percentage of abnormality than those taken after 30 minutes had elapsed. The rapid disappearance of abnormal electroencephalographic findings points, in our opinion, to some mechanism in concussion other than petechial haemorrhage, cerebral contusion, embolic phenomenon, or any other histo-pathological change which must of necessity require several days to disappear.

5. In the patients with abnormal electroencephalographic records the average velocity of the striking object or of the falling head at the time of impact was greater than the velocity necessary to produce concussion in experimental animals as determined by others. The average velocity of the striking object or falling head in patients who showed normal or borderline electroencephalo-

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graphic records was less than the velocity necessary to produce concussion in experimental animals.

6. The study of the electroencephalographic records taken immediately following mild head injury was less reliable than clinical judgment in predicting time loss from work. An ultimate opinion of the value of EEGs in this respect will depend upon a study of a group of more severely injured patients. (Authors' abstr.)

Experimental Chronic "Epilepsy" in the Baboon and Epileptiform Seizures in the Dog, Rabbit and Guinea-pig.

Experimental chronic "epilepsy" has been produced in the baboon and African green monkey by a single application of alumina cream to the motor cortex. After a clinically free period, reactions first occurred 7 weeks and 3 months respectively after operation. These observations parallel the results obtained previously in a large series of *rhesus* monkeys.

Rabbits similarly treated reacted 3–4 weeks after operation with acute convulsive attacks of short duration.

Recurrent epileptiform seizures were induced in the guinea-pig following an intra-cerebral injection of the same material. The convulsive pattern differed from that observed in the primates. Dogs and cats failed to respond to the cerebral application of alumina cream. However, alumina A caused immediate acute convulsions in dogs, but produced no seizures in cats. (Authors' abstr.)

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Neurosis and Alcohol.

Sixteen cats were trained to adapt to situations of increasing complexity; first they opened a box of food, then they were taught to feed only after specific sensory stimuli, and finally they learned to manipulate a switch in various positions to actuate their own feeding signals. When alcohol was administered, these patterns disappeared in the order of decreasing complexity of integration, until only the original, primitive feeding reactions remained. After recovery the animals were subjected to a severe motivational conflict, and developed inhibitions, phobias, loss of dominance, somatic manifestations of anxiety and other behavioral abnormalities typical of an experimental neurosis. Alcohol partially disintegrated these complex responses, restored direct goal-behavior and thereby temporarily relieved the neurosis. Ten of the animals, after sufficient experience with this effect, continued to prefer alcohol to non-alcoholic liquids until their neuroses were relieved by various experimental procedures. The significance of these findings with regard to the psychodynamisms and therapy of alcoholic addiction in man is briefly discussed. (Author's abstr.)

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A Contrast between the Electrocenephalograms of 100 *Psychoneurotic Patients and those of* 500 *Normal Adults.*

1. The EEG of the psychoneurotic patient shows no gross abnormalities of wave pattern and in general falls within the normal range.

2. Nevertheless, a study of the findings on a group of 100 psychoneurotic patients reveals that their electroencephalographic data lie only just within the range for normals, and that the distribution of their data is statistically different from that of a group of 500 normal adults.

3. The statistically significant differences between the total psychoneurotic group and the normal group were in the following characteristics of the EEG:

(*a*) The distribution curve of dominant frequencies in the psychoneurotic group was not that of a normal population.

(*b*) The incidence of beta activity (18·0 cycles and over) was higher in the psychoneurotic group than in the normals.

4. The clinical subgroup diagnosed as anxiety neurosis had a normal distribution curve for dominant frequencies, but in a range faster than normal (mean 11·2 for anxiety neurosis as against 10·6 for normals.)

5. A discussion is presented of the possible physiological mechanism which may be responsible for these findings. (Authors' abstr.)

A Seven-Year Survey of Insulin Treatment in Schizophrenia.

In our experience insulin has been of definite value, but by no means as effective as the early enthusiastic reports led one to believe. Lately this seems to be the impression gained by others too. Several findings are of significance: (1) Worthwhile results are obtained only in cases of a duration up to 1 and 2 years, and possibly 3 years. (2) The treatment causes quicker remissions. (3) 73 per cent. of the patients paroled 6 years ago have been returned to the hospital. (4) Age of the patient and the type of schizophrenia are not significant factors. (5) The number of treatments given and comas produced bear no constant relation to the results obtained. In other words, increasing the length of treatment and number of comas does not increase the parole-rate. The author's firm impression is that if a patient does not show *definite* improvement by the time he has had 25 to 30 treatments and half as many comas, he will not become sufficiently well to be paroled no matter how many further treatments and comas he receives. Any improvement that does occur will be fleeting in nature. (6) Good remissions may be obtained with as few as 15 to 20 treatments and relatively few, if any, comas.

These facts indicate that the last word has by no means been said in the treatment of the functional psychoses. Although we know some of the physiological effects of insulin, its *modus operandi* as a therapeutic weapon in schizophrenia is unclear. Much work has yet to be done on the psychological and physiological aspects of schizophrenia, and insulin treatment can help along *both* these lines. The writer believes that the psychologically therapeutic aspects of the treatment need closer scrutiny. Many of the facts lead to the conviction that it is not merely insulin-hypoglycemia that counts, but the specific *insulin-treatment-situation* which does. The fact that principally cases of short duration do so well is understandable only from this point of view. These patients are close enough to reality to respond to the treatment-situation, whereas the others are so withdrawn and psychologically fixed that the very same drug can have little or no effect. This has led to the conclusion that if the patient does not respond within 25 to 30 treatments, he cannot meet the situation. No amount of similar treatment thereafter will help him. This need not produce pessimism in us. Rather, we may direct our research efforts into channels which discover the nature of the character-structure of those patients who respond favorably, the meaning this particular treatment-situation has for patients generally, and the type of treatment-situation which may aid those not benefited by the insulin-treatment situation. (Author's abstr.)

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A Comparative Study and Evaluation of Electric Shock Therapy in Depressive States.

A group of 70 patients with various forms of depression have been reviewed for immediate as well as late therapeutic achievements with electric convulsive shock treatment, the efficiency of which was considered with reference to several standard criteria, chiefly derived from experiences in a clinically comparable group of 68 control patients. This study led to the following observations on the value of electric shock therapy:

1. The improvement rate was 30 per cent. and the recovery rate 44 per cent. higher with than without shock therapy, whereas the increase rate of relapses or failures during the first year after discharge was almost twice as high in the controls as in the treated group of patients.

2. Marked improvement or full recovery is at times accomplished in chronic depressions of completely disabling degree, where inherent trends toward remission are apparently lacking.

3. Spontaneous remissions are markedly enhanced in degree and quality of improvement.

4. The length of a depressive episode and the need for hospitalization are reduced by 75 per cent. to 90 per cent. of the computed average duration in untreated attacks.

5. A maximal therapeutic gain of 52 per cent. was achieved in involutional melancholias. This gain is especially impressive if one takes into consideration that this form of depression has the least favourable prognosis among the various diagnostic types and without shock therapy.

6. The commonly discussed prognostic indicators regarding the outcome of shock therapy appeared too inconsistent in their implications, and insufficiently explored in detail to be adequate for practical clinical considerations.

7. Manifest untoward effects of electric shock therapy are relatively insignificant as compared to the therapeutic gains. (Authors' abstr.)

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Cerebrospinal Fluid Pressure under Conditions Existing at High Altitudes: A Critical Review.

There is no evidence that reduced atmospheric pressure itself has any influence on the intracranial pressure.

The expansion of gas in the bowel at reduced atmospheric pressures may cause increases in intracranial pressure secondary to a rise in venous pressure.

Anoxia due to breathing air at reduced atmospheric pressure may cause increased intracranial pressure as a result of the production of cerebral edema.

The increase in arterial blood pressure due to the anoxia of high altitudes may be a possible factor in the initial increases of intracranial pressure.

Changes in the rate of production or of absorption of cerebrospinal fluid under conditions of anoxia may serve to compensate against increases in intracranial pressure produced by the mechanisms listed in the preceding three paragraphs.

Increases in intracranial pressure observed in studies on man and on experimental animals subjected to high altitudes have not been of such magnitude as to give them great clinical significance.

For the proper investigation of intracranial pressure at various altitudes, the following factors should be studied quantitatively: (*a*) Venous pressure; (*b*) presence of abdominal distension; (*c*) oxygen tension in the gas mixture breathed; (*d*) oxygen saturation of the blood; (*e*) cerebrospinal fluid pressure, determined with a manometer of not more than 1 mm. bore; (*f*) in animal experiments, amount of cerebral edema due to anoxia; (*g*) chronicity of the anoxia, and (*h*) in experiments on man, emotional response and bodily relaxation, and, in experimental animals, relaxation as influenced by the depth of anesthesia.

Experimental evidence as it appears in the literature indicates that significant increases in the intracranial pressure will not occur in the sick or wounded during transportation by air provided anoxia is not permitted to develop. (Authors' abstr.)

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Pathology of Demyelinating Diseases as an Allergic Reaction of the Brain.

Up to the present the difficulty in the evaluation of the pathologic process of demyelinating diseases has centred, in the author's opinion, around four factors: (1) A tendency on the part of investigators to create easily new clinical or pathologic entities; (2) lack of discrimination between chronic and acute pathologic changes; (3) individual tendencies to be dogmatic in interpretation of the vascular reaction and labelling of the pathologic process as inflammatory or degenerative; and (4) lack of experimental support for the establishment of a link between an acute and a chronic pathologic process on the basis of vascular reaction.

1. The tendency to create easily new clinical and clinicopathologic entities has been particularly evident in the field of the demyelinating diseases. In a tentative classification, published in 1937, the author attempted to eliminate a considerable amount of confusion centred around a multitude of processes for which various names had been coined. The confusion stimulated by the creation of Schilder's disease included the diseases which bear the names of Devic, Balò, Krabbe, Foix and Alajouanine and Pelizaeus and Merzbacher.

The new nomenclature, including such terms as centrolobar sclerosis, encephaloleukopathia scleroticans, leukodystrophy, degenerative subcortical encephalopathy, leukoencephalopathy myeloclastica primitiva and encephalomyelomalacia chronica diffusa, added confusion to a point at which neither the clinician nor the neuropathologist could see his way clear.

Minimal clinical or pathologic deviations cannot constitute grounds for the creation of new clinicopathologic entities when one takes into consideration the variations related to the acuteness or chronicity of the process, the age of the patient and the individual resistance of the nerve tissues. Unfortunately, these factors have often been minimized and new clinicopathologic entities soon added to express what presumably were only various aspects of the same fundamental process.

2. A second source of error in the interpretation of the pathologic features of demyelinating disease has been the lack of sufficient discrimination between the acute and the chronic changes of the process. It goes without saying that the pathologic characteristics of an acute lesion may not be the same as those of the chronic lesion. Too often the difference in the pathologic features supposedly existing between an acute and a chronic demyelinating process is based on disregard of the fact that in the acute stage of demyelinating disease the process is in its development, whereas in the chronic stage important transformations of some reactions, in addition to the process of repair, may have taken place.

On the other hand, one must not forget that even in the course of typical multiple sclerosis phases of reactivation may occur, expressed in terms of both clinical and pathologic exacerbation. A study of the so-called fresh areas of demyelination which develop in the course of chronic sclerosis reveals the same histologic features observed in the acute processes of demyelination, ranging from pathologic changes of the blood-vessel walls and perivascular exudate, in which both lymphocytes and compound granular corpuscles are represented, to thrombi, hemorrhages and necrosis.

3. The third point of controversy relates to the interpretation of a pathologic process as inflammatory or degenerative. Here, again, the individual variations determined by the intensity and the duration of the pathologic process must be considered. Variations in connection with the intensity of the process are to be expected. In cases of dementia paralytica with classic symptoms microscopic examination has revealed considerable variation in the intensity of the perivascular infiltration, the amount of exudate being enormous in some cases and only moderate in others. Degenerative changes have been proved to predominate over the inflammatory changes in the juvenile form of dementia paralytica, whereas perivascular infiltration predominates in the so-called fulminating form.

With demyelinating processes, also, one should not be surprised to find cases in which the perivascular infiltration is outstanding and others in which this feature is much less pronounced.

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Evidently the question may concern the degree of intensity of the same reaction, and not different pathologic processes.

To label a process as degenerative just because the perivascular infiltration is minimal means losing track of the process as a whole, and disregarding the important possibility that mild reactions may be dependent on the intensity of the pathologic process and on the individual tissue resistance. In addition, the age of the process must play a part in the histologic appearance of the lesion. The paucity of perivascular reaction in the so-called chronic stage of epidemic encephalitis is familiar to all.

One solution of the difficulty in interpretation of the presence of perivascular exudate has been to include this reaction under "symptomatic inflammation." In this term the various authors have found an escape from, rather than an explanation for, the presence of a perivascular reaction associated with a lesion of supposedly degenerative nature.

How intense this symptomatic type of perivascular reaction should be to qualify for such a label has been left entirely to the individual investigator, no satisfactory standard having been set. Thus, study of the same histologic slide by two different pathologists might result in the diagnosis of the same process as inflammatory by one and as degenerative by the other. On the other hand, one must keep in mind the fact that in demyelinating disease there is no parallelism between the inflammatory reaction and the intensity of the degenerative changes. The perivascular infiltration is encountered in areas in which little or no substantial degeneration of the parenchyma is noticeable, not to mention the frequent presence of exudate in the meninges in areas not related to underlying degeneration.

It is disturbing that the same reaction can be interpreted as the result of two basically different processes. Such elasticity in the interpretation of the pathologic process leading to two opposing concepts of the same process may have resulted from lack of knowledge of a possible common link which would permit evaluation on the basis of variations of the same process, rather than of fundamental differences. Such a link might be furnished by the studies on experimental cerebral anaphylaxis. The comparison of this pathologic process to that of demyelinating diseases suggests, in the author's estimation, that a common denominator in the pathologic features may be found in an allergic reaction of the nerve tissue.

The pathologic changes associated with experimental cerebral anaphylaxis briefly reported in this paper have been utilized here as a comparative standard for the evaluation of the pathologic process of demyelinating disease. Emphasis has been placed on the analogy of the two conditions, with a view to establishing a possible common physiopathologic reaction.

It is true that one seldom observes with demyelinating diseases the outstanding hemorrhages typical of the Arthus phenomenon. One must, however, remember that such hemorrhages are characteristic only of the very acute and the very early stages of the reaction. It is also true that polymorphonuclear elements have rarely been reported in the perivascular exudate of demyelinating diseases, but one must remember that the leukocytes begin to disappear as soon as a few hours after the onset of the anaphylactic reaction, and that gradually the polymorphonuclear cells are substituted by lymphocytes. Practically no leukocytes are present in the later stages, when the reaction has changed from a polymorphonuclear-hemorrhagic to a lymphocytic-histiocytic type.

4. In the acute, experimentally induced type of poliomyelitis the same changes occur. The exudate, which in the very early stages is formed of polymorphonuclear cells, changes into one of lymphocytes as the disease progresses. This change in the type of exudate is important, because cases of human poliomyelitis have been reported in which the exudate was formed by lymphocytes, and not by polymorphonuclear cells. But even in the absence of polymorphonuclear leukocytes Pette formulated the concept that preceding the stage of lymphocytic infiltration there presumably always is, in the severe type at least, a stage of polymorphonuclear infiltration. He, however, expressed the possibility that in cases of mild poliomyelitis the stage of leukocytic infiltration may fail to appear. In cases of acute demyelinating diseases in which autopsy is generally performed several days after the onset of the disease, one should not be surprised at the absence of leukocytic infiltration.

As for the rest of the pathologic picture, both with anaphylaxis of the brain and with demyelinating diseases, acute or chronic, patchy or diffuse, there occur the same fundamental processes of edema, lymphatic stasis, necrosis, lymphocytic-histiocytic reaction, giant-cell formation and repair.

None of these individual components of the histiologic picture, taken separately, constitutes a characteristic or is pathognomonic of the anaphylactic reaction. However, evaluation of the histologic picture as a whole, with consideration for all the various components, constant or inconstant, should ultimately determine its interpretation.

It is the author's impression that unification of the pathologic syndrome of demyelinating diseases appears plausible as the expression of an allergic reaction of the nerve tissue. This unification has in its support the opinions expressed by investigators that from a clinical standpoint the demyelinating diseases are simply the expression of variations of the same fundamental process and the clinical impression as to their allergic nature already expressed.

The analogy of the cerebral pathology of demyelinating diseases and the pathology of cerebral anaphylaxis will open new avenues to the interpretation of the pathogenesis and histogenesis of multiple sclerosis, diffuse sclerosis and the acute encephalomyelitides.

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The question arises now as to the factors responsible for the allergic reaction. The answer is difficult, especially in view of the fact that apparently different etiologic factors seem to result in the same clinicopathologic picture. The virus of vaccinia, of rabies, of measles, of influenza and of chicken-pox, as well as the streptococcus of scarlet fever, all seem to bring about the same results. If one wishes to speculate on recent statements that a protein molecule constitutes the central nucleus of certain viruses, one could here find a possible explanation of the identity in type of cerebral reactions precipitated by various viruses.

On the other hand, the antigen may not necessarily originate from an infectious process. Products of intermediary metabolism could speculatively be held responsible for the production of antigens. Accurate dietary and metabolic studies in cases of demyelinating diseases might lead to the finding of additional etiologic factors, in the direction of allergic reactions rather than in that of deficiencies. The predominance of multiple sclerosis in certain geographic areas might also center around common dietary factors.

Esotoxins or endotoxins of bacteria, which are at the basis of the so-called Shwartzman phenomenon, or phenomenon of local sensitivity, may, through the same mechanism, result in allergic involvement of the cerebral tissue.

The importance of contributory factors in precipitating or aggravating an allergic reaction of the brain would also find its support. Some of these factors have been investigated experimentally. The contribution of Vaubel, Knepper and Knepper and Waaler on the value of precipitating factors, such as fatigue and hyperventilation, the action of external agents, such as trauma, cold or heat, and the influence of endocrine products has demonstrated the importance of contributory factors in determining not only the intensity but the localization of the allergic reaction in certain organs.

Once the initial pathologic basis has been established in the brain, additional factors may play a role in the progress of the disease or in its phases of reactivation. The author refers to the possible development of antigen (anaphylactogens) from the white or from the gray matter. The studies of Bailey and Gardner have established that antigenic substances can be derived from myelin sheaths. That the brain has immunologic properties which make that tissue almost as organ specific as the lens of the eyes is known. The brain-specific antigens, or haptens, have been claimed by some authors to have the properties of lipids only, whereas other authors (Bailey and Gardner) expressed the belief that the antigen of brain broth may be either a polysaccharide complex or a protein derivative.

Interpretation of the pathologic process of demyelinating disease on the basis of allergy could clarify the still existing confusion as to the significance of the perivascular and histiocytic reaction, so often disregarded or minimized in the study of the cerebral pathology, and might offer a common ground for evaluation of the vascular reaction as a whole under the term " hyperergic inflammation," already coined by Rossle, or of " reactive allergic inflammation," which the author would like to propose.

Interpretation of the pathologic picture of demyelinating disease in the light of an allergic reaction does not exclude the histogenic origin of plaques through thrombus formation, as maintained by Putnam and his co-workers.

As far back as 1939 Putnam and Alexander, in discussing the cause of thrombus formation in demyelinating diseases, stated:

" The fact that similar ' encephalomyelitides ' may be provoked in animals by the injection of organ extracts and bacterial products furnishes a possible explanation for the post-infectious types. Some thrombi may be of ' allergic ' origin (Dietrich and Schroder, Alexander and Campbell). A great group remains, however, in regard to which there is no precise information."

In 1941 Putnam again expressed the view that the origin of encephalomyelitis is in some sense an allergic reaction, adding that " it seems not unreasonable to suppose that an instability of the clotting mechanism of the blood might be one aspect of allergy."

That interference with circulation of the blood is part of the allergic reaction has been established experimentally by Doerr, who reported that capillary and pre-capillary vessels react to anaphylactogen with changes in caliber (dilation and constriction) and with changes in permeability (edema and diapedesis).

Abell and Schenck, using the transparent chamber technic devised by Clark and co-workers, were able to compare the behavior of the arterioles, capillaries and venules of a normal rabbit with the corresponding vessels in the same rabbit after sensitization and injections of anaphylactogen. They observed that in a rabbit sensitized to horse serum, intravenous injection of this antigen may be followed by (*d*) arteriolar contraction with obliteration of the lumens of the arterioles and stoppage of the circulation, (*b*) increased adherence of leukocytes to the endothelium of the blood vessels and emigration of leukocytes through the walls of the capillaries and venules in large numbers, and (*c*) sticking of leukocytes to each other to form clumps or emboli, which block the circulation in many capillaries and venules.

In addition to thrombosis, allergy may produce vascular damage in the form of periarteritis, intimal hyperplasia, fibrinoid degeneration of the intima and media (Fox and Jones) and periarteritis nodosa (Vaubel, Rich and Gregory).

This vascular pathologic process, called hyperergic arteritis by Vaubel, and leading to reduction or occlusion of the lumen of the blood vessels, was also reported by Knepper and Waaler, in an article on functional hyperactivity of the lungs and heart in the course of experimental allergy.

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Vasospasm in the course of allergy was advocated by Gerlach and by Knepper and Waaler, and mechanical occlusion of capillaries resulting from surrounding edema was predicated by Gerlach.

It is certain that variability of the coagulation time accompanies allergic reactions. However, there seems to be a difference of opinion as to whether the coagulation time is shortened or prolonged (Urbach and Gottlieb). In the so-called hemoclastic crisis of Widal, there are, for instance, decrease in the leukocyte count, relative lymphocytosis, decrease in the amount of protein colloids, lowering of blood pressure and increase in coagulability of the blood.

The unification of the pathologic changes in the brain under the heading of allergic reaction would offer a new avenue of interpretation in the field of prevention and therapy of the important group of demyelinating diseases on an immunologic basis. In this connection, Horton, Wagener, Aita and Woltman, of the Mayo Clinic, have made a preliminary report of their attempts to treat multiple sclerosis, especially in the acute stage, with intravenous injections of histamine. The authors seem inclined to relate any recovery and improvement to vasodilatation in the central nervous system resulting from repeated injections of histamine. One could, however, speculate on another explanation of the beneficial effect of histamine, based on the work of Fell, Rodney and Marshall and of Cohen and Friedman on the production of histamine-specific antibodies by the use of histamine as a specific hapten conjugated by an inert protein carrier. In the experience of Fell and associates, histamine-specific antibodies were sufficient to prevent the anaphylactic shock resulting from intravenous injection of a shock-producing dose of protein. The prevention of the anaphylactic shock might be related to neutralization or destruction of the hypothetically liberated histamine. It is this explosive liberation of histamine which, according to Dale, is the cause of the anaphylactic shock. (Author's abstr.)

The Human Pyramidal Tract. X. The Babinski Sign and Destruction of the Pyramidal Tract.

1. The evidence appears to be overwhelming that the sign of Babinski can be elicited in persons with no loss of pyramidal tract fibers.

2. A small percentage of persons without any manifestations of neurologic disease may exhibit the Babinski sign on proper stimulation.

3. A temporary sign of Babinski can be produced in normal subjects under various conditions, as follows: (*a*) Severe exertion; (*b*) subjection to the action of depressant drugs; (*c*) spontaneous or induced hypoglycemia; (*d*) deep sleep; (*e*) blood disorders; (*f*) ingestion of certain toxic chemicals or poisonous gases; and (*g*) many miscellaneous conditions.

4. Many systemic or neurologic inflammatory diseases may cause a transient or fluctuating Babinski sign.

5. Pressure on the pyramidal tract almost invariably produces an extensor toe response, which may disappear when the cause of the pressure is removed. In some of the cases in this series no signs of descending degeneration in the pyramidal tract were apparent at autopsy.

6. Remote space-consuming lesions may produce a sign of Babinski through edema, anoxemia or other phenomena.

7. The mechanism involved in producing the sign of Babinski in disease conditions in man may be of a capricious nature. (Author's abstr.)

Electric Convulsive Therapy of the Psychoneuroses.

The question of the advisability of electric convulsive therapy of a psychoneurosis is far more difficult than the advisability of such treatment for the major psychoses. For the affective disorders and for schizophrenia the shock therapies are the only methods in general use, and the results are gratifying in a considerable number of patients. For treatment of the neuroses psychologic methods are available, and electric convulsive therapy would be indicated only if the results were superior. Statistical reports on the results of psychotherapy with the neuroses, regardless of the form used, seem to vary within narrow limits, as has been observed only recently with war neuroses. In most statistics on peace-time neuroses the percentage of patients showing improvement ranges between 60 and 70 per cent. when persons showing great improvement and those showing slight improvement are considered together. Our figures for electric convulsion therapy reach these values only for a few types of neurotic patients.

On the other hand, the results do not preclude the use of electric convulsive therapy in well-selected cases. The actual dangers of this method are so few that one is justified in discussing indications purely from the point of view of expected results. The following recommendations are made on the basis of clinical experience with the series of 65 neurotic patients presented in this paper.

Patients with anxiety neurosis should be excluded from treatment because they have the poorest chance of improvement. The same holds good for patients with conversion hysteria, for whom treatment is hazardous because they may react to unpleasant sensations during the treatment with the development of new symptoms. Only when such symptoms may substitute for a depressive episode or when psychotherapy has failed might electric convulsive therapy be tried. Extreme caution should be applied in the selection of patients, and the availability of a simple mechanical method should not prevent the psychiatrist from using a psychologic approach to the patient's psychologic problems.

The situation is different in the case of patients with a severe obsessive-compulsive neurosis

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of long standing. If such patients have lost their social usefulness and their joy of living and if adequate psychotherapy has failed, or cannot be afforded, an attempt with electric convulsive therapy is justified. A point in favor of the use of electric convulsion therapy is the possibility that neurotic symptoms are the first clinical expression of a psychosis. Occasional improvement in cases of obsessive-compulsive neuroses stimulates speculation regarding the relation of this condition to schizophrenia.

Psychoneurotic depressions should be treated in any case in order to clear the depression, even if the patient may remain neurotic. Many cases of an apparently reactive depression are actually cases of a manic-depressive psychosis, for which convulsive therapy is the treatment of choice. It is equally justifiable to treat the ill-defined neuroses of episodic character in which physical complaints and general listlessness are clinical expressions of an underlying depression.

The optimal number of treatments, satisfactorily determined in our experience for the various major psychoses, cannot easily be stated for the neuroses. In patients for whom treatment is intended mainly to relieve tension and to overcome resistance to psychotherapy, a series of a few treatments, with longer intervals and avoidance of confusional states, is preferable. For depressive syndromes the optimum will be six to eight treatments, as given for other depressions. For obsessive-compulsive neuroses twenty treatments, considered as a minimum in treatment of schizophrenia, are given in order to achieve at least temporary disappearance of obsessive thoughts and compulsions.

The authors' experience does not permit as clear a statement for or against electric convulsion therapy for the psychoneuroses as can be made regarding its value for the manic-depressive and involutional psychoses, as well as for acute schizophrenia. In general, the final results with neurotic patients are unsatisfactory. It may be stated, however, that careful selection of patients and well-planned application in combination with psychotherapy lead to fair results in a limited number of patients. The improvement does not resemble, either in type or in degree, that obtainable with a proper application of electric convulsive therapy with certain types of psychoses. (Authors' abstr.)

Electroencephalographic Evaluation of Psychopathic Personality : Correlation with Age, Sex, Family History and Antecedent Illness or Injury.

1. Fifty-four per cent. of a series of 68 patients with a condition diagnosed as psychopathic personality, for which no organic cause was suspected, had abnormal electroencephalograms, characterized principally by the presence of slow or very slow waves.

2. When the electroencephalograms were classified according to the Gibbs, Gibbs and Lennox scale and compared with the electroencephalograms of their groups of neurologic normal controls and epileptic patients, the distribution for the patients with psychopathic personality was radically different from the distribution for the other two populations.

3. Age and sex were unrelated to electroencephalographic abnormality.

4. Significantly greater proportions of abnormal electroencephalograms were found when there were both a positive family history (of psychosis, maladjusted personality, chronic alcoholism or epilepsy) and a personal history of cerebral trauma or severe illness than when neither of these factors was present. The statistical significance was not so great when only one of these factors was operating. However, the higher incidence of abnormal electroencephalograms associated with any one of these factors was probably not due to chance. (Authors' abstr.)

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Mental Symptoms Following Head Injury: A Statistical Analysis of Two Hundred Cases.

Of a group of 200 patients, post-traumatic mental symptoms developed after head injury in 31·5 per cent. A number of extrinsic and intrinsic factors were examined in relation to the development of these symptoms. Pretraumatic factors having a high incidence of post-traumatic mental symptoms were advancing age, the married status in men, certain national stocks, certain occupations, the type of injury and, among the psychiatric disturbances, pretraumatic symptoms based on anxiety. Post-traumatic factors having a high incidence of post-traumatic mental symptoms were the initial occurrence of coma and post-traumatic amnesia, certain accompanying injuries, a prolonged stay in the hospital and the presence of headaches and dizziness. In particular, prolonged duration of headaches and dizziness was associated with a high incidence of mental symptoms. Other physical sequelae of the injury lasting more than six months had an equally high incidence of mental symptoms (73 per cent.). Post-traumatic nightmares were regularly associated with additional symptoms of anxiety. In addition, certain environmental complications, occupational difficulties in particular, and problems of litigation and compensation were correlated with a high incidence of post-traumatic mental symptoms.

Of the patients with post-traumatic mental symptoms, the largest group, 48 patients, had post-traumatic anxiety states. Twenty-three of these patients had previously normal personalities, whereas the remainder had pre-existing psychiatric liabilities. In all but one of these 48 patients the issue was complicated by environmental difficulties, such as occupation, litigation, etc.

The post-traumatic neuroses of all but 3 of the 26 previously normal patients conformed to the picture of anxiety neurosis. The psychiatric syndrome in patients with pretraumatic psychiatric complications varied through modification of the pre-existing condition, although 19 of the 26 patients presented predominantly anxiety symptoms.

Whereas anxiety symptoms were the predominant mental feature in the post-traumatic neuroses, particularly neuroses in previously normal patients, symptoms of personality change only, such as euphoria, moodiness and apathy, in addition to changes in the intellectual status, were presented by 7 patients with severe head injuries.

Mental symptoms, particularly symptoms of anxiety, are, with headaches and dizziness, the commonest symptoms in convalescence. They are also the most common symptoms relating to disability and are undoubtedly the major cause of disability, in particular of prolonged disability. A number of factors enter into the production of such anxiety symptoms, the most direct being reproduction of fears related to the injury and accentuation and elaboration of pre-existing conflicts in relation to occupational and financial questions. The latter factor accounts for the delay in onset of mental symptoms observed in several patients until they had recovered physically and were again faced with their obligations. (Author's abstr.)

Delirium. III. Electroencephalographic Changes Associated with Acute Alcoholic Intoxication.

Acute alcoholic intoxication was induced in 7 normal subjects with normal electroencephalograms, and in 4 subjects with chronic alcoholism who had occasional convulsions associated with drinking bouts and whose control electroencephalograms showed abnormally fast or slow activity. The distribution of frequencies was determined, and, in addition, the mean frequency was calculated. In all instances the development of intoxication was accompanied by progressive slowing of the brain waves, but the degree of slowing proved a more reliable index than the development of any particular wave frequency. Expressed in terms of mean frequency, gross intoxication was associated with a change in mean frequency of two to three cycles per second. When the pre-intoxication record was fast or fast normal, the record obtained during gross intoxication had a frequency distribution within the normal range (8 to 12 waves per second) and contained no frequencies below 7 waves per second. Indeed, some abnormally fast records became more " normal " during intoxication. With recovery the electroencephalogram returned to the preinduction status. A close correlation was demonstrated between the electroencephalogram and the level of consciousness, but not with the more personal aspects of behavior.
(Authors' abstr.)

Action of Barbiturates on the Cerebral Cortex: Electroencephalographic Studies.

In this study the electroencephalogram has been used in an attempt to elucidate the mechanics of cortical cell respiration *in vivo*.

One of the barbiturates—sodium amytal (in 20 experiments), sodium pentothal (in 50 experiments) and sodium pentobarbital (in 2 experiments)—was given intravenously to 32 patients.

For every subject to whom the barbiturate was given the electroencephalogram showed the development of high voltage fast activity.

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In the patients who received larger doses per kilogram of body weight a second effect developed; this consisted of slow delta waves (3 to 4 per second).

In every subject the high voltage fast activity appeared first in the frontal leads, then in the parietal leads and finally in the occipital leads, and it disappeared in the reverse order. In other words, the regions of the cortex which are the most recent in phylogenetic development are most vulnerable to the action of barbiturate, as evidenced by the electroencephalogram.

In the first few minutes of injection, at the stage of maximal action of the drug, the patient may be unconscious without the appearance of any of the brain waves typical of sleep. At a later stage the patient may sleep deeply under the influence of the drug, at which time the electroencephalogram may show typical waves for normal sleep, but on the patient's arousal it will revert to the high voltage fast activity specific for the barbiturate. (Authors' abstr.)

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PHILADELPHIA NEUROLOGICAL SOCIETY.

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Interpretation of Findings in the Cerebrospinal Fluid: (1) *The Dementia Paralytica Formula and the Necessity of Its Quantitative Differentiation.*

The formula as encountered in cases of typical untreated dementia paralytica is one of the most distinctive and important diagnostic findings concerned with the cerebrospinal fluid. It provides the main prognostic differentiation of neurosyphilis, possibly in early asymptomatic stages. Qualitatively, it is characterized by the combination of a positive reaction of syphilis and a dementia paralytica (parenchymatous) colloidal gold curve and, quantitatively, by a strength of all reactions which is unrivalled by other forms of neurosyphilis. From the practical standpoint its varying resistance to specific therapy is most significant.

A correct evaluation of the dementia paralytica formula requires the elimination of "false dementia paralytica curves," due either to confusion with first zone curves or to an unsatisfactory pH of the milieu. The qualitative differentiation of the dementia paralytica curve from all other types of curves is based on the presence of an abnormal pseudoglobulin-like "dementia paralytica substance," indicating extensive parenchymatous degeneration. This explains the grave prognostic significance of any dementia paralytic curve, irrespective of whether it is encountered as an element of the dementia paralytica formula or as part of the "syndrome of multiple sclerosis."

When quantitatively standardized methods are used, particularly in the determination of total protein and in the colloidal gold test, striking quantitative differences in dementia paralytica formulas are demonstrable. Of cerebrospinal fluids that were submitted for control of treatment, only about one-third yielded "true dementia paralytica formulas, as encountered with dementia paralytica," and two-thirds were notably weaker. Whether a true dementia paralytica formula, detected in the early asymptomatic stage, means prospective development of the disease cannot be determined; besides, the question is comparatively irrelevant. At the moment of the detection, the problem of the presumptive resistance to antisyphilitic treatment is paramount, since it determines the selection of adequately intense therapy. The direct determination of this resistance by follow-up examinations may involve a waste of time and money.

Without premature conclusions, the results of quantitative methods suggest that the resistance to antisyphilitic treatment roughly parallels the strength of the dementia paralytica formula, which is best expressed by the total protein concentration. It is suggested that the current qualitative concept of the dementia paralytica between this formula and its varying resistance to therapy on the basis of quantitatively different types be studied.

(Authors' abstr.)

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Prefrontal Lobotomy in Treatment of Chronic Psychoses, with Special Reference to Section of the Orbital Areas Only.

In a series of 22 patients with mental disorders, chiefly paranoid schizophrenia, a satisfactory therapeutic result was obtained with a modified technic of prefrontal lobotomy, in which only the orbital areas were sectioned.

The orbital areas of the frontal lobes seem to have a role in regulation of the emotions. (Authors' abstr.)

Electroencephalographic Evaluation of Primary Behavior Disorders in Children: Correlations with Age, Sex, Family History and Antecedent Illness or Injury.

1. As has frequently been shown, there is a high incidence of abnormality in the electroencephalograms of children with primary behavior disorders. In the present series of 67 children, none of whom presented signs of organic disease or in whose condition an organic etiologic factor was suspected, 49 per cent. had electrical brain potentials which were clearly abnormal.

2. Age and sex were unrelated to electroencephalographic abnormality.

3. Significantly greater proportions of abnormal electroencephalograms were found when there was either a history of psychosis, maladjusted personality, chronic alcoholism or epilepsy in the family or a personal history of cerebral trauma or severe illness than when neither of these factors was present. (Authors' abstr.)

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Mental Organization and Age Level.

1. The purpose of the study was to investigate the hypothesis that intelligence is relatively generalized in young children, but that as age increases there is a gradually increasing specialization of mental abilities, which should result in a decrease in the correlations between tests of different group factors and an increase in the correlations between tests of the same group factor.

2. In order to test this hypothesis a battery of eight tests, consisting of three tests of verbal ability, two tests of number ability, two tests of memory and one test of spatial relationships, was administered to children of three different age levels—9, 12 and 15 years. Correlations between the tests at each age level were computed for boys and girls separately.

3. The average correlations showed an increase from 9 to 12 years and a decrease from 12 to 15 years. The boys showed a sharper increase than the girls, and the girls showed a sharper decrease than the boys.

4. In conformity with the data the original hypothesis was amended as follows: Beginning with a minimum of integration at birth, there is a gradual increase in integration of mental ability, which reaches a maximum at approximately 12 years of age, after which there is a decrease in relationship due to the crystallizing out of group factors. It was suggested that the increasing integration is related to an increase in the stability of attitudinal influences, such as attention and interest.

5. The failure to obtain increases in the intragroup correlations with increasing age was attributed to the difficulty of obtaining tests of pure group factors, inasmuch as all the tests included varying amounts of other factors in addition to the one to be tested. Furthermore, the abilities employed in the performance of any task have been shown to vary with age, with the difficulty of the task, and even with the structure of the relationships among primary abilities in mental organization. (Author's abstr.)

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A Study of Personality Syndromes.

In accordance with the distinction drawn between the parameters and the variables of personality eleven "general traits" defined by Murray (6) were subjected to a *syndrome analysis of parameters* for two groups of subjects. Group A consisted of 28 college men; Group B of 41 private school-children.

There are five basic steps involved in performing a syndrome analysis:

(1) Calculating a complete table of intercorrelation of the measures.

(2) Selecting an arbitrary value of r to represent the minimum acceptable r for inclusion of a measure in a cluster. This may be labeled $r_{min.}$, and in the examples above was ·50 for Group A and ·40 for Group B. With relatively small samples it is convenient to select a value near the 5 per cent. or 1 per cent. levels of significance.

(3) *Preliminary clusters* are defined by the following criteria:

(*a*) Every measure in a cluster correlates $r_{min.}$ or more with every other measure in the cluster.

(*b*) No measure not in the cluster correlates $r_{min.}$ or more with *every* measure in the cluster.

(*c*) No cluster is completely contained in another cluster. (This follows automatically from the first two criteria.)

(4) The highest 25 per cent. of the subjects and the lowest 25 per cent. of the subjects are selected on each of the preliminary clusters, using the average of the scores on the component measures to select the "high" and the "low" subjects, provided that the several scores are homogeneous. The selection of these extremes should not be construed as "proving anything by extremes" since one half of the subjects fall into these categories. Its purpose is to aid in combining similar clusters *after eliminating subjects with idiosyncratic collections of ratings.*

(5) *Preliminary clusters which define approximately the same "high" and "low" subjects are combined to form the final syndromes.* In order for two clusters to be combined, at least 75 per cent. of the extreme subjects on one must be extreme in the same direction on the other, and *no* subject may be "high" on one cluster and "low" on the other.

Four syndromes were identified in Group A and five in Group B. Of these, four in the latter group correspond very closely to those in Group A, the fifth being of doubtful significance. These syndromes of the general traits, considered as parameters of personality, were defined at both ends of the scale:

I. *Imaginative, creative introversion* vs. *Practical, conventional extraversion.*
II. *Creative expressiveness* vs. *Apathetic conventionality.*
III. *Unorganized expressiveness* vs. *Organized perseverance* (among the College men of Group A) or *Apathetic withdrawal* (among the children of Group B).
IV. *Disorganized emotionality* vs. *Organized control.*

Differences between the syndromes in Group A and those in Group B were discussed briefly in the light of the differences in age and in educational environment. The discussion serves to illustrate (*a*) that differences between groups may be expressed in the *patterning* of the parameters of personality, and (*b*) that a single aspect of personality becomes more meaningful when it is embedded in a context of related aspects of personality. Thus, for example, syndromes I and II are both *creative*, the first being *imaginative and introverted*, the second, *expressive* and outward-going. Syndromes II and III are both *expressive*, the first being *creative*, the second, *unorganized*—probably together with a lack of creative capacity and opportunity. Syndromes III and IV both have to do with *organization*, the first describing a *lack of organization* in behavior the second, *disorganization* in behavior. The several syndromes in which a single measure may appear must be carefully considered for an understanding of the complexities surrounding the elements of personality. (Author's abstr.)

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The Minnesota Multiphasic Personality Inventory. V. Hysteria, Hypomania and Psychopathic Deviate.

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obtained with both normal and psychiatric cases between the given scale and the seven other scales included in the Minnesota Multiphasic Personality Inventory.

G. R. THORNTON (Psychol. Abstr.).

A Note on the Clinical Use of the Hunt Minnesota Test for Organic Brain Damage.

The Hunt-Minnesota Test for organic brain damage has been applied clinically to 68 patients. The results, when compared with the final clinical evaluation, agreed in 54 cases, disagreed in 7 cases, and were invalid in 7 cases because of poor co-operation, etc. On the basis of clinical experience with the test, comments are made concerning use of the shortened form, the relationships of age and vocabulary status to scores on the test, the use of the interpolated tests as indicators of poor co-operation and the like, cases involving brain damage occurring before attainment of maturity, repetition of test, remission of deterioration, relation between intellectual deterioration and various types of brain damage, and vocational and psychiatric prognosis of cases with mild deterioration.

G. R. THORNTON (Psychol. Abstr.).

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Experimental Catatonia in Rats Produced by Centrifugation.

Centrifugation catatonia of rats presents a whole gamut of motor signs exactly as when the syndrome was brought about either chemically or by other means. The lowest doses of centrifugation produced hypokinetic signs; the increase of the dose the same signs, sometimes with the addition of hyperkinesis. The occurrence of convulsive seizures and death after overdosage was also in accordance with findings in other kinds of experimental catatonia.

Post-mortem examination of the brains of animals which were centrifuged to death showed signs of hyperemia, swelling and hemorrhages inside and outside the brain with varying localizations.

(Author's abstr.)

Oscillographic Studies of Bulbocapnine Tremor and Catalepsy in Macacus Rhesus.

Tremor in experimental catatonia induced by bulbocapnine in a *Macacus rhesus* was studied. Although the rate of the tremor pointed to an involvement of the basal ganglia, it was emphasized

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that this fact is insufficient to permit an identification of the picture of bulbocapnine intoxication with the Parkinson syndrome. Essential differences from the latter exist, and only identification with the human catatonic syndrome accounts for all the symptoms induced by bulbocapnine in the animal series. Electromyography by means of the ink-writing oscillograph confirmed the conception of active immobility of the cataleptic muscles. (Authors' abstr.)

An Investigation of After-images.

The after-image behavior of over 700 young subjects was studied, using with some subjects the "blink" method with the dark-adapted eye, and with others the fixation of pictures after the technique of Kluver. A grading scale was worked out in order to classify subjects according to their after-image performance. The present investigation revealed nothing to substantiate the claim that some special "eidetic" ability exists. After-image ability of a marked degree might be termed "eidetic," but it should not be implied that any sharp difference exists between so-called eidetikers and non-eidetikers. After-image abilities of a random group of subjects appear in a continuum. It is highly improbable that there is, as Kobusch says, a continuum of steps between the pure eidetic image and the pure memory image. The eidetic image is merely a vivid after-image, due probably to persistence of activity in the retina. There seems, however, no real reason why the ambiguous and misleading "eidetic image" phraseology should be maintained. It is suggested that the term eidetic imagery be dropped from our already overburdened psychological terminology.

1. The incidence of varying grades of after-image ability on a scale of five steps was found to be: A (highest ability), 9·3 per cent.; B, 9·8 per cent.; C, 19·1 per cent.; D, 31·7 per cent.; E, 30·1 per cent.

2. Of 256 child subjects 69·6 per cent. saw an after-image of a picture. The after-sensations were reported as: Grays only, 8·6 per cent.; all or in part complementary colors, 13·3 per cent.; positive images only, 48 per cent.

3. Of 22 subjects who reported gray after-images 18 were weak in color discrimination, as shown by the Ishihara Test of Color Blindness.

4. There appears to be a definite, positive relationship between age and ability to experience after-images.

5. Boys did not appear significantly different from girls in their after-image abilities.

6. From the present data after-image ability and intelligence appear to be associated, though the correlation is not high.

7. Studies of the relationship between after-imagery and performance in spelling, English composition and art revealed a statistically reliable relationship in the case of art achievement, an insignificant but strong trend for association in the case of spelling, while there was no more than chance relationship with English composition. (Authors' abstr.)

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Psychometric Trends in Senility and Psychoses of the Senium.

The test records (Wechsler-Bellevue) of 100 aged (60 years and over) individuals, some psychotic and some not, were analysed in considerable detail. On the basis of the data obtained and analytic procedure followed, the following conclusions seem to be justified:

No significant differences in psychometric patterns between the several senile diagnostic groups of the patient population were obtained. This fact may be partly due to the inevitable overlapping in the diagnoses.

The total, quantitative scores are lowest in senile psychosis and arteriosclerosis and highest in the remaining two groups of miscellaneous psychoses and non-psychotic.

The discrepancies between the verbal and performance scales, frequently considered as an indicator of inefficiency, tend to be largest in senile psychosis and become lower in the following descending order—arteriosclerosis, miscellaneous and non-psychotic.

Highest scores and ordinal positions are obtained on verbal and untimed power tests, while lowest scores are obtained on timed performance tasks.

It is suggested that the general preservation of information and comprehension is due to the fact that they are tasks based on material learned at an early age. This is consistent with the clinical observations in old age. The consistent decline in the "substitution" test (digit symbol) is also consistent with clinical observations, and suggests the increased perseveration and inflexibility of older individuals.

The factor of age, probably more so than differential diagnosis, is important in the significant decline and negative correlation of the "timed" test items. This is similar to the conclusion in respect to memory stated in an earlier investigation.

With the exception of a generalized decline in absolute score values and the relative positional constancy of such subtests as information comprehension and similarities (high) on one hand and digit symbol and picture arrangement (low) on the other, increasing age levels show no significant changes in "patterning."

The author's findings fail to agree with Wechsler's dichotomy of tests which "do and do not hold up with age."

The similarity between the patterns in old age and schizophrenia is only partial and not better than chance. The statement that schizophrenia resembles "premature ageing" cannot be subscribed to in the light of the present findings. (Author's abstr.)

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The Bruns Syndrome.

The Bruns syndrome is characterized by three features: (*a*) Vertigo, vomiting, headache, and visual disturbance on change of posture of the head; (*b*) a freedom from symptoms between the episodes; (*c*) posturing of the head.

The condition has been most often described in association with cysticercus of the fourth ventricle. It is also found with tumours of the midline in the cerebellum and with third ventricle and lateral ventricle tumours. The origin of the symptoms has been attributed to blockage of the ventricular system on change of posture of the head and to obstruction of flow of the cerebrospinal fluid. A pathological study of five cases suggests the possibility that the disturbance in the vestibular mechanism in the brain stem may be responsible for the symptoms.

S. M. COLEMAN.

Ataxia Associated with Cerebral Signs.

Report on 5 patients showing marked cerebellar ataxia, intention tremor, dysarthria, involvement of the pyramidal tracts, with convulsions in 2 and dementia in 3 cases. None of the patients had a familial or hereditary history. Etiologically 2 were thought to be due to chronic alcoholism, 1 possibly to multiple sclerosis. S. M. COLEMAN.

Effects of Barbiturates and Bromides.

Review of the medical literature of the last five years dealing with the neuropsychiatric effects of bromides and barbiturates. Two case reports are included to demonstrate the psychiatric syndrome of bromide delirium and barbiturate intoxication. S. M. COLEMAN.

Psychiatric Aspects of Epilepsy.

It is found that in institutionalized epileptics the manifestations observed are predominantly psychogenic in origin. The writers conclude that defective personality integration takes precedence over purely anatomical and circumscribed physiological factors in influencing the development of chronic epileptic psychoses and deterioration. S. M. COLEMAN.

SEPTEMBER.

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Compensation of Nervous Function.

As a neurological term, compensation always means a new function replacing another one, definitely lost. It should not be confused with restitution or substitution. The principle of compensation is derived from the principle of the organism without appealing to any vital power isolated from the organism; it is interpreted solely on the ground of the mutual relationship and interdependence of the parts. Compensation serves the purpose of satisfying the (organogenetic) needs of the remaining parts. It should also be distinguished from intentional effort and training. S. M. COLEMAN.

Sleep Paralysis.

Two cases illustrating the typical features of sleep paralysis with other disturbances of a narcoleptic nature are presented. In both hypnagogic illusions were prominent, and in one precipitation of attacks by terrifying dreams occurred frequently. It is concluded that sleep paralysis is a non-diagnostic symptom which may occur in narcolepsy or independently in otherwise healthy individuals, and that it may be due to a variety of causative factors.

S. M. COLEMAN.

OCTOBER.

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*Graphology and Medicine. *Eliasberg, W.* 381

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Unusual Reactions to Electroshock.

A review of 357 patients treated by electroshock showed a number of unfavourable reactions. In the treatment room were disproportionate number of *petit mals* (28), panic reactions and perseverative speech. Later reactions were increased restlessness and agitation without much clouding, dazed retardation and states of excitement and unco-operativeness.

S. M. COLEMAN.

Eidetic Imagery in a Psychosis.

Report on a psychotic woman, aged 31, whose delusional system was based on eidetic imagery. The history showed her to be a lifelong eidetic, interviews and tests confirming this. There was no evidence of visual hallucinations, though, depending on the definition of the term, pseudo-hallucinations may have been present. The literature on eidetic imagery is reviewed.

S. M. COLEMAN.

Graphology and Medicine.

In America there are two developments of graphology, character graphology and the technical knowledge of handwriting. The author thinks it is unfortunate that these two should be kept apart. Medicine may use graphology for the diagnosis and prognosis of such diseases as cancer, tuberculosis, rheumatism and pathological ageing. There is great scope for further research in developmental graphology and pathographology. S. M. COLEMAN.

J. NEUROL. NEUROSURG. PSYCHIAT., LONDON.

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*The Scope and Limitations of Visual and Automatic Analysis of the EEG. *Dawson, G. D., and Grey Walter, W.* 119

Electroencephalography in Cases of Sub-cortical Tumour.

1. Special automatic analysis and accurate location procedure have been used in the electro-encephalography of cases with cerebral tumours affecting sub-cortical structures.

2. In 31 cases subsequent operation or post-mortem revealed the site and extent of the tumour.

3. In cases with superficial tumours spreading inwards, the site of the tumour exhibited 1–3 c/s. (delta) waves; the adjacent areas and parieto-temporal regions showed activity at about 6 c/s.

4. In cases with deep tumours spreading outward the main feature was 6 c/s. activity from the cortex above the tumour and/or from the parieto-temporal regions. A small delta rhythm was sometimes seen immediately above the tumour or as a general effect of raised pressure.

5. In cases with deep tumours not affecting the cortex, the 6 c/s. rhythm was the only significant abnormality. This was usually from the parieto-temporal region, and often could only be distinguished from the normal alpha rhythm by analysis.

6. In cases with more widespread new growth, the 6 c/s. rhythm was seen whenever the basal structures were affected.

7. The occurrence of rhythms at about 6 c/s. from the parieto-temporal region in these cases is related to the similar rhythms found in other clinical and physiological conditions where the basal structures are involved, and also to the effect of experimental lesions of the basal ganglia in monkeys.

8. It is suggested that rhythms at about 6 c/s. should be termed "theta" rhythms, and that such rhythms are characteristic of the resting, immature or isolated parieto-temporal cortex.

(Authors' abstr.)

The Wernicke Syndrome.

A pathological investigation has been made in seven cases presenting the Wernicke syndrome. In two cases there was a history of alcoholism and in three of pernicious anaemia; in one the condition followed hyperemesis gravidarum and in one it followed gastric carcinoma.

The last case has been decribed in full, as it was distinguished by an atypical clinical course in which mania was present for a considerable time. It is important that the oldest and severest lesions were localized in the anterior portion of the hypothalamus. The incidence of manic syndromes associated with hypothalamic lesions has been discussed in the light of previous experimental and pathological observations.

The same case of gastric carcinoma had a peculiar cerebellar lesion affecting predominantly the granular layer.

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In four of the five cases which were fully investigated inferior olives were damaged in a characteristic way, the neurones of the medio-dorsal corner undergoing homogenizing degeneration. The possibility of a deficiency factor in the pathogenesis of the olivary lesions has been discussed. (Author's abstr.)

The Electroencephalographic Localization of Intracranial Neoplasms.

Results obtained by EEG in 120 intracranial tumours and 5 abscesses are tabulated and discussed. About 50 per cent. of accessible lesions were correctly localized. It is not considered that cerebellar tumours are normally localizable.

There is a somewhat greater tendency to slowing of the alpha rhythm than in other cases, including acute head injuries. Asymmetry of alpha rhythm is an inconstant but sometimes useful finding.

The record associated with raised intracranial pressure is exceedingly variable, and bears no direct relationship to the height of the pressure nor to the degree of papilloedema, but some to the state of consciousness.

The " ideal " method of localization is the finding of phase-reversal of slow waves, but not infrequently one must depend upon their maximum intensity. Where a number of slow rhythms are present the slowest is usually of major significance for localization.

From the accessible tumours nine normal records were obtained, of which seven were from parasagittal lesions, emphasizing the well-known difficulty in their localization.

Hyperventilation is unlikely to do more than accentuate the features of the resting record.

It is suggested that the 4–7/sec. frequency band or theta rhythm has a special significance, and is associated with lesions in the region of the third ventricle. A number of cases are described in which this concept has proved of localizing value. (Author's abstr.)

The Electroencephalogram in Traumatic Epilepsy.

Electroencephalograms have been recorded in large groups of patients with idiopathic epilepsy, traumatic epilepsy and with head injuries without epilepsy, as well as in a large control group of normal subjects. EEGs were also obtained before and after the onset of traumatic epilepsy in a small group of subjects.

The records in these groups have been compared, and the results obtained show that larval epileptic outbursts in the EEG are invariably associated with overt fits, while less well-defined paroxysmal outbursts are also frequently associated with fits. These disturbances, which occur in 25 per cent. of traumatic epileptics compared with 56 per cent. of idiopathic epileptics, may be used with other signs to predict the likelihood of traumatic epilepsy. In other cases of head injury when these changes are absent, the EEG offers no such help. The likelihood of epilepsy supervening when these disturbances are present has been examined in closed and penetrating head injuries.

The records made before and after the onset of fits show that the characteristic episodic changes often appear in the EEG before the onset of traumatic epilepsy.

The site and nature of the disturbances in traumatic epilepsy are described. A distinction is made between the immediate and direct effects of trauma upon the EEG and the remote, indirect and persistent effects which are usually associated with epilepsy. The results are compared with those of other workers, and are used in discussing the relationship of symptomatic to idiopathic epilepsy. (Author's abstr.)

The Relation Between the Effects of the Blood-Sugar Levels and Hyperventilation on the Electroencephalogram.

1. The response of the EEG to hyperventilation at raised blood-sugar levels has been studied in 71 adult patients who showed instability of cortical rhythms when fasting. The subjects include patients with epilepsy (22), neurosis (17), psychopathic personality (17), and post-traumatic states (9).

2. Two types of reaction have been observed ; one (group 1) in which raising the blood-sugar level inhibits the appearance of slow rhythms, and another (group 2) in which, although there is a reduction in amount, slow rhythms are still elicited with a blood-sugar value of 130 mgm. per cent. or above.

3. There is a significant relation between the degree of abnormality of the resting EEG and the group into which a case falls. Those cases with a normal or mildly abnormal resting EEG tend to fall into group 1, and those with a more than mildly abnormal resting EEG into group 2.

4. All the neurotics are found in group 1 and all the epileptics in group 2.

5. Instability of the EEG on hyperventilation at blood-sugar values above 130 mg. per cent. is significant, and its presence in these circumstances markedly increases the probability that the patient is an epileptic. (Author's abstr.)

The Scope and Limitations of Visual and Automatic Analysis of the Electroencephalogram.

1. The complex nature of the waves recorded in the EEG is considered.

2. The use of a synthetic method for demonstrating the formation of complex waves, such as occur in the EEG, is described.

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3. Mixed rhythms of types common in the EEG are synthesized, and the effects on the form of such rhythms of variations in the size and frequency of their components is demonstrated.

4. Certain types of waves which have entirely different compositions are shown to be indistinguishable to the eye.

5. The specific forms that are produced when certain common harmonically related components are added together are shown.

6. The effects on the above forms of the phase relations of the components are demonstrated.

7. The use of the specific forms as a basis for deducing the presence in the EEG of rhythms not obvious to the eye is indicated.

8. Simplification of the EEG by the use of close bipolar leads is suggested.

9. It is suggested that many of the complex EEG wave forms are due to the simultaneous generation of a number of harmonically related sinusoidal waves.

10. The application of the principles described to EEG examination both with and without automatic analysis is discussed, and the limitations and possibilities of visual and automatic analysis of the EEG are considered. (Authors' abstr.)

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*Midbrain Auditory Mechanisms in Cats. *Ades, H. W.* 415
*Paralysis with Hypotonicity and Hyperreflexia Subsequent to Section of Basis Pedunculi in Monkeys. *Cannon, B. W., Magoun, H. W., and Windle, W. F.* 425

A Note on the Two Components of the Dorsal Root Potential.

The potential in one dorsal root produced by the stimulation of another and distant dorsal root naturally divides itself into two parts. The first part has the characteristics of being not appreciably affected by strychnine, but readily abolished by sectioning the dorsal columns of the cord between the stimulating and leading roots. The second has the opposite characteristic, viz. it is greatly enlarged and prolonged by strychnine, but quite undiminished by the sectioning of the dorsal columns. To explain this difference, the most obvious supposition to make seems to be that the first part of the potential results from impulses reaching the region of the third root terminations directly from the ascending collaterals of the ninth root in the dorsal columns, while the second is produced by impulses pursuing a more devious course among the internuncial neurone chains between the two roots. For, assuming as is usual that the action of strychnine lowers synaptic resistances, a striking effect of this drug is only to be expected where there are many synapses to be traversed. And given a sufficient lowering of synaptic resistances, it is not surprising that the stimulation of the ninth root can exert its undiminished influence on the third root even after their direct fibre connections in the dorsal columns are severed. The second part of the dorsal root potential recorded evidently has its origin in the activity of the internuncial neurones. Whether the first also involves internuncial neurones or not cannot

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be so definitely stated. But it is in accordance with the economy of hypothesis to suppose that even the first part is due to certain internuncial neurones in the immediate neighbourhood of the third root terminations activated directly via the ascending collaterals of the ninth root.
(Authors' abstr.)

Receiving Areas of the Tactile, Auditory and Visual Systems in the Cerebellum.

1. By determining the occurrence and distribution of evoked electrical responses it has been shown that there are, in the cerebellar cortex of the cat, distinct areas which receive nerve impulses from tactile, auditory and visual receptors.

2. The receiving areas for impulses of tactile origin are located in three parts of the cerebellum. In each lateral half of the anterior lobe and in adjacent folia there is a projection of the ipsilateral half of the body surface in which the feet and the vibrissae are the parts most conspicuously represented. The forefoot and hindfoot of one side are represented in both paramedian lobules, the forefoot having a stronger contralateral representation than the hindfoot. In the rostral area (anterior lobe and adjacent folia) the tactile representation shows an anatomical localization in the sense that different zones are related to different parts of the body surface.

3. The auditory area is largely restricted to the lobulus simplex and the tuber vermis. In most cats it extends somewhat into the posterior folia of the culmen, the anterior folia of the pyramis, the medial portions of crus I on each side and both paramedian lobules. The responses evoked by auditory stimuli are not affected by decerebration at an intercollicular level. They are abolished by section of the eighth nerves or destruction of the cochleae or removal of the inferior colliculi. They are not altered by section of the fifth nerves.

4. The visual area overlaps the auditory and in most cats the two areas are conterminous. The cerebellar responses to photic stimuli are not modified by bilateral section of the fifth and seventh cranial nerves or by removal of eyelids and extra-ocular muscles on both sides. They are unaffected by removal of all cerebral neocortex, and depend on a pathway which probably involves the superior colliculi.

5. Full anesthetic doses of sodium pentobarbital appear to have little effect on the tactile responses, but they markedly depress the auditory and completely abolish the visual. The auditory and visual areas are most clearly revealed when chloralosan is used as the anesthetic.

6. It is suggested that cerebellar functions are influenced by tactile, auditory and visual stimuli as well as by impulses from proprioceptors and from the cerebral cortex.
(Authors' abstr.)

Spreading Depression of Activity in the Cerebral Cortex.

In rabbits under dial narcosis, weak faradic or mechanical stimulation of the exposed cerebral cortex elicits a characteristic response designated " spreading depression."

Shortly after the stimulation the spontaneous electrical activity decreases markedly at the stimulated region. The depression then slowly spreads in all directions, successively affecting adjacent areas. Within 3 to 6 minutes it involves all of the dorsolateral cortex, except the area retrosplenialis granularis dorsalis (Rsg β_1 of Rose). The depression can be initiated in any of the regions involved in the spread, but is usually more readily obtained from the frontal than from the occipital areas.

Recovery of the initial pattern of spontaneous activity is slow; it requires, as a rule, 5 to 10 minutes at each region. The spontaneous activity at the stimulated region is often well recovered at a time when the depression is just starting in distant parts. If only weak stimuli are used, depression at any region runs the same course regardless of what region is stimulated.

Only with supraminimal stimulation does the depression spread to the opposite hemisphere, then appearing first in the region symmetrical to the point of stimulation and thence spreading as in the stimulated hemisphere.

The spreading depression affects not only the spontaneous electrical activity, but also several cortical responses, i.e. responses to touch, to electrical stimulation of afferent nerves, to illumination of the retina, to ipsilateral or contralateral cortical electrical stimulation; and to local application of strychnine or of eserine plus acetylcholine. Single shocks applied to a depressed region fail to elicit typical responses in the opposite non-depressed hemisphere.

Specific activity, different from the spontaneous, often develops during the period of depression of a region. The most common type of this activity is composed of large, slow, localized potential waves, during which one electrode becomes negative with respect to others 1 to 3 mm. distant. Fast components may also appear, and the activity when intense closely resembles the " seizure pattern " of experimental epilepsy.

The depression and " tonic-clonic " activity of experimental cortical epilepsy seem to be closely related phenomena. The spread of tonic-clonic responses is probably mediated by the same cortical elements which are involved in the spread of depression. The two processes are mainly or exclusively cortical, i.e. they do not require a contribution from sub-cortical centers. Their development and characteristics are not determined by the stimuli, but depend on the local characteristics and conditions of the affected regions. (Author's abstr.)

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Influence of Conditioning Nerve Stimuli on Relayed Volleys Evoked from Spinal Cord. Periodic Facilitation and Inhibition.

Local stimulation with needle electrodes placed laterally in the spinal cord elicits a number of oscillations of synchronized impulses which have been picked up in the peroneal nerve. The different synchronized waves of this complex response can be inhibited or facilitated by a conditioning stimulus to the ipsilateral popliteal nerve in a manner dependent upon the time interval between the conditioning stimulus and the test stimulus to the spinal cord.

It is shown that the conditioning stimulus causes a rapid periodic variation of inhibition and facilitation in which four inhibitory minima and four excitatory maxima can be noted. The number of such depressions and facilitations may vary from experiment to experiment, but their temporal location with respect to conditioning stimulus is constant within relatively narrow limits. (Author's abstr.)

Sustained Facilitation and Post-Inhibitory Rebound of Relayed Volleys in the Spinal Cord.

In earlier experiments on reflex muscular contractions rebound contractions have been noted after both ipsilateral and contralateral flexor reflexes and possible explanations have been suggested, in particular by Sherrington. The experiments described in this paper add a new factor by pointing to the significance of proper timing of the interacting stimuli, and correlating the phenomenon with the inhibitory phase of the periodic variations following a stimulus to the center. At the same time they confirm Sherrington's original view that rebound is a consequence of preceding inhibition.

In the earlier reflex work rebound was sometimes noted without preceding inhibitory relaxation and assumed by Graham Brown to be "concealed." Similarly, in this work, it has been noted that rebound occurs after stimulation with a combination *representing an inhibitory interval*, even when the actual inhibition has been slight or absent. It is clear that an average reaction such as a reflex muscle contraction must then be able to exhibit rebound without evident signs of a preceding inhibition. Nevertheless the necessity of using an inhibitory interval between conditioning and test stimulus in order to elicit this phenomenon demonstrates the essential place of pre-excitatory inhibition in the rebound reaction.

It may be of interest to point out that the retinal off-effect in a like manner pre-supposes pre-excitatory inhibition, and that recently Bremer has shown that there is a similar off-effect or rebound in the acoustic area of the cat.

The sustained facilitation, studied by Eccles and Granit in both contralateral and ipsilateral reflexes, also is a quite regular phenomenon, referable to the stimulation intervals at which periodic facilitation occurs and can be analyzed in the manner described. (Author's abstr.)

Midbrain Auditory Mechanisms in Cats.

1. The contribution of discharge through the inferior collicular commissure is negligible in the total activity of the inferior colliculus.
2. As measured electrically, the contribution of the contralateral ear to collicular response is slightly greater than that of the homolateral ear.
3. The explanation of functional bilateral equality in auditory conduction from either ear probably lies in bilateral terminations of secondary auditory fibers in the superior olivary nucleus, which contributes substantially to the lateral lemniscus.
4. Functionally significant numbers of fibers of lateral lemniscus bypass without synapsing in the inferior colliculus.
5. The inferior colliculus discharges through the superior colliculus.
6. The inferior colliculus is an important reflex center capable of auditory integration.

(Author's abstr.)

Paralysis with Hypotonicity and Hyperreflexia Subsequent to Section of Basis Pedunculi in Monkeys.

Interruption of the basis pedunculi in the monkey gives rise to a paralysis which is intermediate between spastic paralysis and hypotonic paresis. This paralysis is characterized by hypotonicity of all muscle groups, excepting the extensors of the digits, by hyperactive deep reflexes and by the absence of clonus.

This leads to the assumption that inhibitory pathways descending from the cerebral cortex do not course entirely within the basis pedunculi. Fibers whose interruption is responsible for the phenomenon of hypertonicity and those dealing with clonus, for the most part, have deviated from the corticospinal projection prior to reaching the cerebral peduncle. Those whose interruption leads to hyperreflexia accompany the cortico-spinal projection while passing through the cerebral peduncle but deviate before reaching the pyramids. (Authors' abstr.)

VOL. VIII. JANUARY, 1945.

*Degree and Nature of Regeneration of Splanchnic Innervation to the Adrenal Gland Two Years Following Complete Bilateral Sympathectomy in Dogs. *Papez, J. W., Jensen, A. V., and Dukes, H. H.* 1
*Restoration of Vision after Crossing of Optic Nerves and after Contralateral Transplantation of Eye. *Sperry, R. W.* 15

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*Observations of Gas Bubbles in Pial Vessels of Cats Following Rapid Decompression from High Pressure Atmospheres. *Wagner, C. E.* 29
*Propagation of Spreading Cortical Depression. *Leão, A. A. P., and Morison, R. S.* . 33
*Influence of Depletion of Diffusible Electrolytes upon Electrical Activity of the Brain. *Pick, E. P., and Miller, M. M.* 47
*Functional Organization of the Giant Fiber System of Lumbricus. *Bullock, T. A.* . 55

Degree and Nature of Regeneration of Splanchnic Innervation to the Adrenal Gland Two Years Following Complete Bilateral Sympathectomy in Dogs.

The thoracolumbar sympathetic chain, rami communicantes and splanchnic nerves were removed on both sides in two dogs, a male and female, to determine effects on behavior of dogs under experimental conditions. No changes in behavior were observed.

After a lapse of two years an autopsy was performed to determine the nature and degree of nerve regeneration. Pseudoregeneration of the sympathetic trunk was found on one side in the male and on both sides in the female.

Histological examination of the false nerve trunks showed that they were composed mainly of perineural strands surrounded by connective tissue, the strands containing a few, often scattered, regenerated nerve fibers coming from the 3 or 4 lower thoracic and first lumber rami communicantes. In two instances there appeared to be a regeneration of the typical splanchnic nerves, but these apparent nerves were found to consist of perineural trunks containing a remarkable scarcity of regenerated nerve fibers coming from stumps of the severed rami communicantes.

The regenerated nerve fibers were of small number, often distorted and scattered in the course of the false nerve trunks. More distally they appeared to be lost in the connective tissue as they approached the adrenal gland.

The stumps of severed nerves near the gland contained only a few, if any, nerve fibers.

The number of regenerated fibers which entered the medullae of the glands was very few. The exact number could not be determined. We have estimated them to be not in excess of 5 per cent. in some of the specimens, although the number of regenerated fibers in the false nerve trunks was greater.

There appear to be post-ganglionic vasomotor nerves of a moderate amount coming from the coeliac and periadrenal ganglia which were not affected by the sympathectomies.

A third dog was prepared for study of acute stages of nerve degeneration. Autopsy was performed 14 days after a lower left thoracolumbar and splanchnic sympathectomy and 6 days after a similar operation on the right side. The left side showed complete denervation of the sympathetic chain, splanchnic nerves and adrenal medulla; and the right showed an acute stage of degeneration and fragmentation of nerve fibers in these parts.

The nerves and glands of a fourth normal, unoperated dog were used as technical controls for histological studies.

It seems fair to conclude that regeneration of splanchnic and sympathetic nerves after a total sympathectomy is relatively small, and far smaller within the gland than suggested by the size of the regenerated false nerve trunks when no histological examination is made. Moreover, it is clear that some of the preganglionic neurons in the intermediolateral cell column of the spinal cord survive the operation, and are capable of regenerating axons which tend to course along the older channels that are partially restored by the precocious regeneration of perineural sheaths. A small number of fibers may reach the medulla of the gland in some instances. The evidence presented from two animals is small, and further investigation may show that more regeneration than we have found may occur in the glands in other cases.

(Authors' abstr.)

Restoration of Vision after Crossing of Optic Nerves and after Contralateral Transplantation of Eye.

1. Intrinsically well-organized visuomotor co-ordinations were recovered in 21 anurans after crossing of the optic nerves and in 2 anurans and 12 urodeles after contralateral transplantation of the eye.

2. These recovered visuomotor responses, however, were schematically correlated with the anatomical rearrangements and thus were extremely maladaptive. Hence their intrinsic organization could not be ascribed to learning, and must instead have been a product of the regeneration process itself.

3. The experiments extend the evidence that the re-establishment of functional relations between retina and visual centers is strictly and systematically pre-determined by growth regulating factors irrespective of functional adaptation. (Author's abstr.)

Observations of Gas Bubbles in Pial Vessels of Cats following Rapid Decompression from High Pressure Atmospheres.

Gas bubbles were observed directly in pial blood vessels following rapid decompression of anesthetized cats from air compressed to 75 pounds per square inch (gage pressure). When gas bubbles were visible in pial vessels they always appeared first in the arteries, later in the veins. Gas bubbles were also present in other blood vessels of the body as well as in the right

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auricle and ventricle. Some animals died, although no bubbles appeared in the pial vessels of the microscopic field under observation. Since, in all animals, the distribution of gas bubbles elsewhere in the body was the same, it may be assumed that, in those instances in which bubbles were not seen, bubbles were present in arteries supplying a portion of the central nervous system other than the field under observation. (Author's abstr.)

Propagation of Spreading Cortical Depression.

1. Hitherto unexplored areas of the rabbit cortex were found to exhibit spreading depression, leaving the areas Rsg of Rose as the only major region not participating.

2. Elicitation of the phenomenon in one hemisphere by stimulation of the opposite one was found to depend upon an intact corpus callosum. Such interhemispheric conduction was found to differ importantly from spread of the phenomenon within either half of the cortex.

3. The spreading of the phenomenon was found to be independent of subcortical connections, and indeed of at least the three lower layers of the grey matter. Acute anemia of the cortex, for periods up to a minute in duration, did not interfere in any way with the spread of cortical depression or vasodilatation in progress at the time of onset of the anoxic period.

4. Short weak tetanic stimulation, applied near the surface of the cortex but not to deeper layers, direct current for various periods of application, or isotonic potassium or calcium chloride were most effective in eliciting the process. Physostigmine, acetylcholine, strychnine, cocaine, histamine and adrenalin were found to be ineffective.

5. Cocaine applied to small areas of the cortex was found to restrict the spread of depression and vasodilatation even though it was not placed directly in its path.

6. These observations were discussed and shown to cast doubt upon the hypothesis that the phenomenon depends upon a neuron-to-neuron transmission of " inhibitory impulses." Various other possibilities were discussed. (Authors' abstr.)

Influence of Depletion of Diffusible Electrolytes upon Electrical Activity of the Brain.

1. Frogs can be depleted of 30–40 per cent. of their body chlorides by being immersed in distilled water for periods of several days or weeks.

2. This depletion of NaCl associated with the loss of other diffusible substances as, for example, potassium and calcium salts as well as glucose reduces the electrical brain activity, which is characterized in part by the appearance of Delta-like waves and further in a marked reduction in wave frequency and amplitude. Both of these alteration types can appear at intervals alternately.

3. The degree of reduction of electrical activity can vary in different brain areas and the depressed activity can be restored by intralymphatic injection of small amounts of NaCl. When the electrical activity has been too severely impaired by the excessive loss of diffusible substances, it is not possible to restore the activity by means of administering either NaCl, KCl, or vitamin B.

4. The successful treatment of shock with saline may be in part explained on the basis of the central action of saline in improving the electrical activity, and thereby aiding the restoration of the impaired vital centers.

5. The depression of the electrical brain activity is explained as due to the inhibitory effect upon the oxidative processes of the brain resulting from the loss of NaCl and glucose. (Authors' abstr.)

Functional Organization of the Giant Fiber System of Lumbricus.

1. The giant fiber system of the earthworm is a favorable object for the study of functional organization by means of action potential recording, since its potential spikes are large and simple, few in number, detectable from the surface of the intact animal or from the exposed, intact nerve cord, readily and dependably excitable by electrical stimulation of the surface of the intact animal and by normal mechanical means.

2. A consistent and characteristic pattern of two spikes is elicited by direct electrical stimulation of the cord. The two spikes are of different threshold, conduction rate, height and form, the faster one typically having the lower threshold and the lower amplitude. Each occurs in an all-or-none fashion and stimulus strength has no effect above threshold. They behave as single fiber action currents, and are shown to represent the activity of the giant fibers, the smaller, faster spike belonging to the larger, median fiber.

3. The overall, effective speed of conduction (not counting any utilization time or synaptic delays at the segmental septa) is very high—up to 45 meters or more per second (24° C.)—probably the fastest conducting fibers yet recorded among invertebrates, although they are far from the largest. The time for conduction from head to tail increases as the worm is stretched, but not proportionately, so that the rate also increases. This is a normal, reversible phenomenon.

4. The pattern of two spikes is the same, when elicited by direct electrical stimulation of the fibers, regardless of the site of stimulation, site of recording electrodes or direction of conduction. Evidence is presented that this is because the giant fibers are unpolarized.

5. The pattern of response of the giant fibers to normal mechanical stimulation, as it probably occurs in nature, is described. They are apparently on the efferent side of the reflex arc, but are not probably the final common path. A normal response may consist of a single spike or a dozen or two at a frequency of 50–200 per second. Only a single spike from, i.e., a single fiber is activated by any one stimulus. The median fiber fires as a result of stimulation

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anterior to about the fortieth segment; the laterals fire to stimuli posterior to this point. But in either case the spikes are conducted in both directions, to all parts of the worm. The apparent polarization of the system noted by earlier workers is due to regional localization of sensory connections capable of firing the giant fibers.

6. Nicotine in concentrations as high as 1 : 10,000 did not abolish conduction over the giant fibers within 30 minutes.

7. From the physiological evidence certain predictions of histological findings are made. The typical anastomoses described by Stough are confirmed and those of Haller and others are denied on this basis.

8. The high speed of conduction and its unpolarized character are significant in view of the apparently synaptic nature of the system as demonstrated histologically. These properties are compatible with and perhaps constitute a demonstration of recent theories which suppose that the synapse is not inherently polarized nor delaying, but is only so as a result of the particular anatomical relations prevalent in vertebrates, and that these properties should not be a part of the definition of the synapse. This interpretation is in harmony also with recent opinions to the effect that the nerve net of lower invertebrates exhibits unpolarized synapses.

(Author's abstr.)

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Post-Traumatic Headache.

1. Two hundred consecutive hospitalized cases of head injury between the ages of 15 and 55 years, exclusive of chronic alcoholism and vagrants, were followed from the time of injury for a period of six or more months. The investigating team consisted of neurologists, psychiatrists, psychometrist, electroencephalographer and social worker.

2. One hundred and thirty-eight patients (69 per cent.) complained of post-traumatic headaches, 63 patients (32 per cent.) of headaches lasting longer than two months, and 59 patients (30 per cent.) of headaches that did not persist beyond the hospital stay. In 11 patients (6 per cent.) the headaches began after discharge from the hospital.

3. Post-traumatic headaches are regularly intermittent. They may be precipitated by postural changes, effort, fatigue, or emotional upsets, or they may appear without relation to any such factors. They are characteristically variable from patient to patient with respect to severity, character of pain, and localization. This variability is characteristic of all groups of post-traumatic headache.

4. Headaches lasting for longer than two months are characteristically associated with dizziness and nervous symptoms (fears, anxiety, fatigue, irritability and/or inability to concentrate). This association is a statistical reflection of the composition of the well-known post-traumatic syndrome.

5. The incidence of such prolonged headaches was high among patients with nervous or neurotic symptoms prior to injury, with complicating environmental factors (including compensation), with symptoms of marked immediate emotional reaction to the injury, and with scalp lacerations; it was low among recreational accidents, and among patients with very mild head injuries (no measurable duration of coma, disorientation, or permanent post-traumatic amnesia).

6. These relationships suggest the importance of both psychological and physical factors in the production of prolonged post-traumatic headache in the majority of cases. Even in headache localized to the region of known damage to scalp or skull psychological factors had high correlation.

7. A striking liability of headaches localized to the site of previous scalp injury to provocation by posture or physical effort provides evidence that such provocation in more diffuse types of headache indicates underlying structural damage. A liability of provocation by histamine, particularly when the headache had been unilateral, suggests that intracranial localized vascular or perivascular change may occur.

8. Neither changes in the spinal fluid, in the electroencephalogram, in the reflexes, in the degree or extent of scalp or cranial injury nor in the extent of disorder of consciousness immediately after the injury give adequate prognosis of subsequent liability to headache. Headache was, however, significantly less common in those who had no initial disorder of consciousness. Five of the seven cases with no initial disorder of consciousness but persistent headache thereafter had localized scalp injury. (Authors' abstr.)

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