

reply to Mr. WARINGTON the speaker said that the acetic acid fermentation went on in the presence of chloroform.

Mr. KINGZETT called attention to the fact that the oxygen was completely used up when the meat infusion was placed in contact with air. He did not think the experiments represented the action of bacteria on gases or of gases on bacteria, but rather the effects of various gases on the mode and extent of ordinary putrefaction.

Dr. FRANKLAND expressed his satisfaction with the results obtained by the author in his laborious research. He must confess that these results had surprised him not a little. The fact that bacteria, which were real organisms and could not be shielded under the term putrefaction, lived and flourished in  $\text{SO}_2$ ,  $\text{CO}$ ,  $\text{CN}$ , &c., seemed to him very extraordinary, and the question arose whether the germs to which infectious diseases were probably due were not similarly endowed with a power of great resistance to ordinary influences.

Mr. F. J. M. PAGE said that Dr. Baxter had proved that with some fever-producing liquids, their virulence was destroyed by chlorine and sulphuric acid, and that he had seen some experiments at the Brown Institution which led to the same conclusion; so it seemed that, at all events in some cases, the virulence of infective liquids was due to organic matter, essentially different from the bacteria observed by Mr. Hatton.

#### NOTES ON CHICKEN CHOLERA.

We observe in a recent number of the *Chemical News* that C. T. Kingzett, F. C. S., points out, that, in explaining the protective influence of repeated inoculations with the attenuated virus of chicken cholera, against the more virulent forms of this disease, Pasteur finds it "impossible to resist the idea that the microscopic germ which causes the disease, finds in the body of the animal conditions suitable to its development, and that to satisfy the necessities of its life the germ alters certain substances, or destroys them, which comes to the same thing, whether it assimilates them or whether it consumes them with oxygen borrowed from the blood."

So, again, in cases where complete immunity has been attained, the birds "no longer contain food for the germ."

More striking still is the following passage in reference to chickens which are born proof against cholera:—"Animals in this condition may be said to be born vaccinated for this disease, because the foetal evolution has not placed in their bodies the proper food of the parasite, or because substances which would serve as such food have disappeared while they were yet young."

Now whether or not we may be prepared to regard the said parasite as the direct cause of the disease, it is remarkable that the reasoning of Pasteur should have culminated in the conclusion upon which Liebig insisted with considerable power.

If we turn to Gregory's (3rd) edition of Liebig's "Animal Chemistry" (p. 205) we find the following passage:—"The condition which determines, in a second individual, his liability to the contagion, is the presence in his body of a substance which by itself, or by means of the vital force acting in the organism, offers no resistance to the cause of change in form and composition operating on it. If this substance be a necessary constituent of the body, then the disease must be communicable to all persons; if it be an accidental constituent, then only those persons will be attacked by the disease in whom it is present in the proper quantity and of the proper composition. The course of the disease is the destruction and removal of this substance: it is the establishment of an equilibrium between the cause acting in the organism which determines the normal performance of its functions and a foreign power by whose influence these functions are altered."

I repeat that to me it seems somewhat remarkable that the investigations and reasoning of two such eminent (and

in many matters diametrically opposed) thinkers should have culminated in the same conclusion as regards the conditions of the living body which subject it to, or protect it from, infection.

While, however, it can be readily understood how a profuse growth of parasites could quickly alter or destroy a comparatively large amount of substance—as, for instance, happens in ordinary putrefaction—it does not appear to me so easy to accept Pasteur's reasoning as to his so-called vaccination.

In this inflicted process an attenuated virus is introduced into the body of a chicken which becomes ill but does not die. It does not die because, if Pasteur be correct, the parasites do not sufficiently multiply. Why do they not multiply? It cannot be on account of the insufficiency of the pabulum, for in the large majority of cases where death results this seems to arise from the very profusion of the growth of the parasite when more freely introduced.

Can it be expected, therefore, that even, say, in three successive inoculations the substance which I have here spoken of as pabulum can be entirely removed or destroyed by the very limited number of parasites which are introduced by the inoculations, and which so soon perish in the body? I think this cannot be expected; but if it may be, then the particular substance or substances upon which the parasites prey must be extremely limited in quantity. After all, we are faced with the enormous difficulty of ascertaining the nature of such substance, and the further equally great difficulty of understanding why an undiscovered and undetermined substance should be entirely absent from the bodies in some animals and present in varying proportions in others.

Here we come in contact with the weakest point in the parasitic theory. The immunity from a second attack of an infectious disease of the class in question is simply inexplicable under the parasitic theory. We are forced back to an alternative theory, and that is one of which we at present only recognize the beginnings.

#### A NEW CORTICAL CENTRE.\*

By GRAEME M. HAMMOND, M.D., NEW YORK.

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Some six years ago there appeared in the *Centralblatt*, Nos. 37 and 38, a short communication by Betz, embodying an account of certain nerve-cells found by him in the cortex of a region of the brain which he newly named the paracentral lobule. This paper has probably aroused more general attention among neurologists than any other paper of recent times dealing with the structure of the cerebral hemispheres, and this, on account of the anatomical confirmation which the discovery seemed to furnish, of the localization doctrine based on the electrical stimulation of the cortex carried out by Hitzig and Fritzsche.

After localizing these cells chiefly in the paracentral lobule and the upper ends of the pre- and post-central gyri of man, stating them to be very few in number in the lower halves of these gyri, Betz proceeds to say, "the constancy of the occurrence of these cells, not only as regards the cortical layer, but also the special convolutions in which they are found, led me to direct my attention to that portion of the brain of animals, and particularly of the dog, on which latter Hitzig and Fritzsche obtained such brilliant physiological results. I refer to that lobule which bounds the sulcus cruciatus. Now I found in this very lobule in the dog, cells in similar nests and of a similar shape. With the dog as in man they are distributed in the fourth layer."

Engaged in a study of the ganglionic masses of the forebrain of the cat, an animal on which the experiments of Hitzig and Fritzsche have been repeated, and in which

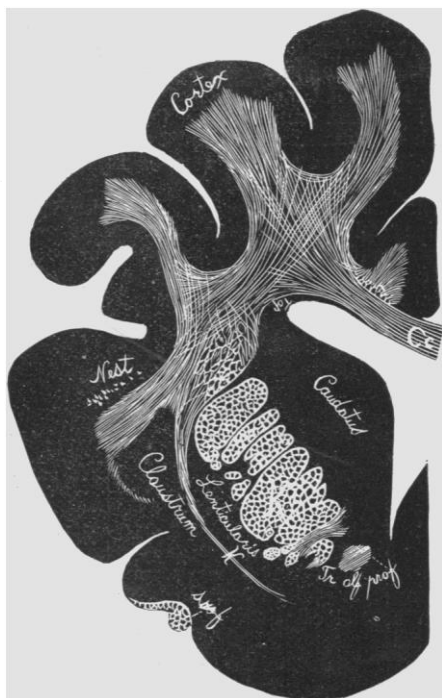
\* Read before the New York Neurological Society, February 1, 1881.

the centres have been localized in regions homologous to those of the dog, and in which, furthermore, the architecture of the cortical surface is fundamentally the same, I proceeded to review the question of the localization of the giant-cells.

On the one hand, Betz seemed to argue that the giant-cells, which he claims to have discovered, were motor, because they were found at those points in the dog's brain where Hitzig and Fritsche, by supposed localized electrization, had produced contractions of special groups of muscles. Again, on the other hand, it is apparent that those interested in defending that narrow localization theory, which is such a prominent feature in the teachings of Charcot and Ferrier, have found one of their strongest supports in the anatomical discoveries of Betz.

Let us suppose then, for the sake of argument, that it be granted that larger cells mean motor centres for larger muscles; taking up the localizationists on their own ground we will examine the location of these giant-cells in a cat's brain, which only differs in a single exception from the dog's, and is therefore a fit subject for study. In fact, the cat's brain has the advantage of being somewhat simpler.

The results I have obtained are based upon the study of the cortical area of the two hemispheres of one cat. One hemisphere was cut as a whole into some seventy-five sections, from different altitudes transversely to the cerebral axis. The other was separated into eleven segments, and each segment cut into a number of thin sections. The series of sections derived from the first hemisphere served as a sort of topographical guide for the location of anything that might be found in the second.

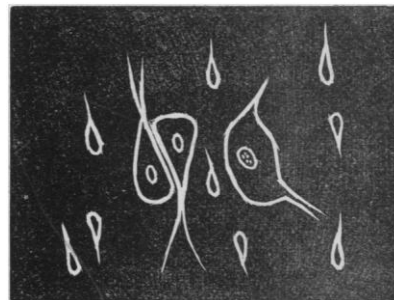


I found that the giant-cells are not confined to localized areas as Betz claims. I find that they are not as numerous near the sulcus cruciatus as they are much posterior to that region. I have even found giant-cells not very far from the base of the brain, but I found the largest group of the largest cells in a place not yet indicated on any of the charts of the localizationists as an unquestionable motor point. In the accompanying woodcut the position of the nest of cells that I have discovered is accurately demonstrated. These cells are ovoid, circular, and

sub-pyramidal in shape, and possess a round nucleolated nucleus situated about the centre of the cell. Each cell has from two to six visible processes. The ovoid cells are much the larger, their long diameter measuring from 0.08 mm. to 0.12 mm.; and their short diameter from 0.05 mm. to 0.06 mm. The circular and subpyramidal cells measure from 0.07 mm. to 0.08 mm. in diameter. The nuclei of all the varieties are of the same size, and measure 0.03 mm. in diameter. I only succeeded in finding them in one locality, but found them very numerous in that area. They are situated in the first primary arched gyrus, between the Sylvian and anterior Sylvian fissures. Ferrier, in his "Functions of the Brain" indicates a "centre" on the frontal division of the fourth external convolution, where, he says, he has observed, on irritating this centre, "a divergence of the lips so as to partially open the mouth." This centre approaches nearer in position to the one I have discovered than any other. With this study I was enabled to locate the chief foci for condensation of the giant-cells, of the shape known to Betz and Mierzejewski. These are pyramidal in shape, with a central round nucleus, and measure from 0.09 mm. to 0.12 mm. in length, and from 0.03 mm. to 0.04 mm. in width at the base. Their nuclei measure 0.02 mm. in diameter. The following woodcut shows how two of Betz's largest cells can be placed so that their conjoined areas are only equal to the areas of one of the ovoid cells such as I have described.

I regard the term "area of large cells" as inaccurate. The large cells are scattered more or less widely over the brain-surface, and it would be better to speak of "foci" when they are concentrated in larger numbers than elsewhere.

The giant-cell of Betz is not a new discovery. It is not a thing by itself distinct from the other pyramidal cells of the cortex. On the contrary, both in the human cor-



tex and in the cat, every transition from the average-sized cell of the third frontal layer to the giant-cell can be traced. I would also call attention to the fact that Betz states "these cells to be in nests" and not uniformly distributed in one layer, but I have seen, in one section from the paracentral lobule of the human brain, giant-cells arranged in regular order like soldiers on parade, for a distance of one-third of an inch.

Taking the deductions, which have been based upon the existence of these cells, on their merits, we find that those who have relied on this demonstration for the support of the theory of motor centres, are reduced to a number of predicaments. 1. That the largest giant-cells have been found in the brain of carnivora where no motor centre has been clearly demonstrated, and near which only small muscles are supposed to receive their cortical innervation. 2. That if, after all, this is a motor centre, that the method of localization was incompetent to detect it. I have limited myself this evening to this single fact. I need not say that the giant-cell was known to Meynert, although its locality was not accurately described by him. He claimed that the larger gyri of the frontal lobe contained the largest cells. On the other hand, cells as large as the giant-cells can be seen through the entire occipital lobe, according to this observer, in

the two white strata, and were described by him by the name of "solitary cells." I trust at no distant date to review the entire question of the distribution of large cortical cells with measurements and to submit them to the society.

For the present I think the existence of the large cortical cell group which I have described, shows conclusively that before the existence of large cells can be considered a demonstration of the correctness of functional localization, a more extended study must be made.

## THE UNITY OF NATURE.

BY THE DUKE OF ARGYLL.

### VII.

#### ON THE MORAL CHARACTER OF MAN CONSIDERED IN THE LIGHT OF THE UNITY OF NATURE.

(Continued).

It may be well, before proceeding farther in this branch of our inquiry, to retrace for a little the path we have been following, and to identify the conclusions to which we have been led.

In the first place, we have seen that the sense of obligation considered in itself—that is to say, considered apart from the particular actions to which it is attached—is a simple and elementary conception of the mind, inasmuch that in every attempt to analyze it, or to explain its origin and growth, this absurdity can always be detected,—that the analysis or explanation universally assumes the previous existence of that very conception for which it professes to account.

In the second place, we have seen that, just as Reason, or the logical faculty, begins its work with the direct perception of some simple and elementary truths, of which no other account can be given than that they are intuitively perceived, or, in other words, that they are what is called "self-evident," so in like manner the Moral Sense begins its work with certain elementary perceptions and feelings in respect to conduct, which arise out of the very nature of things, and come instinctively to all men. The earliest of these feelings is the obligation of obedience to that first Authority the rightfulness of which over us is not a question but a fact. The next of these feelings is the obligation of acting towards other men as we know we should like them to act towards ourselves. The first of these feelings of obligation is inseparably associated with the fact that all men are born helpless, absolutely dependent and subject to Parents. The second of these feelings of obligation is similarly founded on our conscious community of nature with other men, and on the consequent universal applicability to them of our own estimates of good and evil.

In the third place, we have seen that this association of the higher powers of Man with rudimentary data which are supplied by the facts of Nature, is in perfect harmony with that condition of things which prevails throughout Creation,—the condition, namely, that every creature is provided from the first with just so much of instinct and of impulse as is requisite to propel and guide it in the kind and to the measure of development of which its organism is susceptible, leading it with unfailing regularity to the fulfillment of the law of its own being, and to the successful discharge of the functions assigned to it in the world.

In the fourth place, we have seen that the only really exceptional fact connected with Man is—not that he has faculties of a much higher kind than other creatures, nor that these faculties are susceptible of a corresponding kind and measure of development—but that in Man alone this development has a persistent tendency to take a wrong direction, leading not towards, but away from, the perfecting of his powers.

In the last place, we have seen that as a matter of fact,

and as a result of this tendency, a very large portion of Mankind, embracing almost all the savage races, and large numbers of men among the most civilized communities, are a prey to habits, practices, and dispositions which are monstrous and unnatural—one test of this unnatural character being that nothing analogous is to be found among the lower animals in those spheres of impulse and of action in which they have a common nature with our own; and another test being that these practices, habits, and dispositions are always directly injurious and often even fatal to the race. Forbidden thus and denounced by the highest of all authorities, which is the authority of Natural Law, these habits and practices stand before us as unquestionable exceptions to the unity of Nature, and as conspicuous violations of the general harmony of Creation.

When, however, we have come to see that such is really the character of these results, we cannot be satisfied with the mere recognition of their existence as a fact. We seek an explanation and a cause. We seek for this, moreover, in a very different sense from that in which we seek for an explanation and a cause of those facts which have the opposite character of being according to law and in harmony with the analogies of Nature.

With facts of this last kind, when we have found the place into which they fit in the order of things, we can and we do rest satisfied as facts which are really ultimate—that is to say, as facts for which no other explanation is required than that they are part of the Order of Nature, and are due to that one great cause, or to that combination of causes, from which the whole harmony and unity of Nature is derived. But when we are dealing with facts which cannot be brought within this category,—which cannot be referred to this Order, but which are, on the contrary, an evident departure from it,—then we must feel that these facts require an explanation and a cause as special and exceptional as the results themselves.

There is, indeed, one theory in respect to those mysterious aberrations of the human character, which, although widely prevalent, can only be accepted as an explanation by those who fail to see in what the real difficulty consists. That theory is, that the vicious and destructive habits and tendencies prevailing among men, are not aberrant phenomena at all, but are original conditions of our nature,—that the very worst of them have been primitive and universal, so that the lowest forms of savage life are the nearest representatives of the primordial condition of the race.

Now, assuming for the present that this were true, it would follow that the anomaly and exception which Man presents among the unities of Nature is much more violent and more profound than on any other supposition. For it would represent the contrast between his instincts and those of the lower animals as greatest and widest at the very moment when he first appeared among the creatures which, in respect to these instincts, are so superior to himself. And it is to be observed that this argument applies equally to every conceivable theory or belief as to the origin of Man. It is equally true whether he was a special creation, or an unusual birth, or the result of a long series of unusual births each marked by some new accession to the aggregate of faculties which distinguish him from the lower animals. As regards the anomaly he presents, it matters not which of these theories of his origin be held. If his birth, or his creation, or his development, whatever its methods may have been, took place after the analogy of the lower animals, then, along with his higher powers of mind, there would have been corresponding instincts associated with them to guide and direct those powers in their proper use. It is in this essential condition of all created things that Man, especially in his savage state, presents an absolute contrast with the brutes. It is no explanation, but, on the contrary, an insuperable increase of the difficulty,