

naturally the most copious, there is greater susceptibility of this kind, and as a corollary it may be added, there is functional activity in proportion to the normal blood supply. The difference in this respect between the cortical substance and the central parts is most marked. This points to the former as being only subsidiary to the latter, taking the circulation as a physiological basis to judge from in this respect. Although the central and base ganglia are much less in bulk than is the cortical substance, yet, about one-half of the blood which enters the encephalon is distributed to the former. It would be interesting to know if this unequal supply has anything to do with the pathological fact that in hemiplegia from cortical disease we find it "limited, transient, and variable" (Charcot), but in paralysis of the body from central disease it is permanent, general and uniform. It is a pathological fact that paralysis, general or partial, can be produced by *any part* of the brain being affected with inflammation, embolus, or tumour; showing that loss of function is not consequent on degeneration or destruction of some localized spot. That part of the brain which demands the greatest amount of blood in the performance of its work must necessarily have the greatest activity.

Let me then repeat in another form that a very superficial knowledge of the brain circulation indicates how direct and ample is the blood supply to the base and central ganglia in comparison with the cortical supply. This is especially true of the arteries which run to the *corpus striatum* and *thalamus opticus*. The cortical substance is nourished in a roundabout way through the *pia mater*, but the central system is reached directly through the large central vessels springing from the circle of Willis, which furnish a perfect fountain of blood supply near at hand. So distinct and important is the circulation in this grand centre, that when obliteration of the Sylvian artery takes place, all the ganglionic centres are affected, and cerebral hemiplegia accompanied by hemianæsthesia is the result. This physiological fact alone shows the greater importance these ganglia hold—it seems to me—as functional centres in comparison to the cortex or even the

entire hemispheres. Since writing the above, I find that Prof. M. Schiff, of Florence, has caught the same idea, when he says, in his monograph on "motor centres," that "human and comparative pathology have stated with certainty that the motor centres do not extend above the base of the brain." Unless my attempt to be brief has led to ambiguity, it will be seen that among the probabilities of this obscure subject, the explanations I have given in defence of the theory enunciated are based on—

I. The radical difference found in the circulation of the blood, both as to mode of distribution and quantity, leading to the reasonable inference of greater functional activity existing in the centre than in the circumference of the brain. The more life-action in any part, the more is blood supply needed.

II. The want of uniformity in functional results, when definite and alike portions of the cortical substance are stimulated, impaired or destroyed; hence, this cannot be the seat of so-called true motor centres.

III. It would be consonant with pathological and experimental facts to locate these motor and physical centres in the base and centre ganglia; yet in sympathetic relations, being influenced, but not absolutely controlled, by the cortical substance.

IV. The want of distinctive physiological features in the different convolutions.

I will now give a few examples of brain injury, illustrative of these views. The first are culled from the surgical records of the war of the late American rebellion:

Private Hughes was wounded at the battle of Antietam. The hospital reports say that the injury was a perforation of the skull by a single conoidal musket ball entering near the inner posterior angle of the right parietal, and emerging at a higher point of the left parietal, making, after traversing a portion of the brain, a large exit wound. At the time of this extensive injury he dragged himself from the field, but *he did not lose his consciousness*. Eight days after the injury, it is reported the general condition of the patient was good; suppuration had commenced, no febrile action existed, the pulse was regular; sleep not ma-