

maintenance of nerve-function and the perpetuation of processes depending upon it.

In such a case a previously weak organ or centre is the first to suffer. The medulla oblongata is such an organ in this case, and its contiguous centres for respiration and circulation fail together; bad blood and deficient blood, acting on centres previously paretic or enfeebled, have done their work, and again the respiration is suspended. The vasomotor centre is again so functionally weakened that it loses control of the arterial muscle—the “inherent contractile force,” which all physiologists assign to muscular tissue, thus freed (as in the example enumerated above) induces “the strong arterial contraction” referred to by Dr. Sansom, which contraction of the artery is all the stronger the nearer nerve force is to cease in the extinction of life. This arterial, or systemic contraction, again empties the lungs and refills the venous reservoirs from which the blood is again drawn, at first slowly and then again more rapidly, as the process repeats itself. Here, then, is an explanation of the Cheyne-Stokes respiration based upon sound, though as yet unacknowledged, physiological principles according to which paretic and enfeebled nerve centres are helped by their appropriate pabulum—oxygenated blood—and are overwhelmed and have their function suspended by what is naturally calculated to poison and paralyze them, impure venous blood, deficient in oxygen and loaded with carbonic acid.

THE INTESTINAL AND UTERINE MUSCLES.

In sustaining the contention that, as a rule, muscles of the involuntary class contract, not when stimulated by their appropriate nerves, but when deprived of nerve energy, I have not yet alluded to the involuntary muscular fibres of the intestines and uterus. The antagonism of nerve and muscle is not here so evident as in the cases already cited, but here the relations of nerve and muscle have not as yet been completely investigated. (a)

Dr. M. Foster states that section of the vagi “renders difficult the passage of food along the œsophagus,” and causes “a spasmodic contraction of the cardiac orifice of the stomach; in other words, the tonic action of the sphincter is increased”; (b) facts which sustain what has been

already stated above as to the non-paralyzation of the muscles concerned, after section of their nerves. The peristaltic movements of the intestine, he states, may occur “wholly independent of the central nervous system,” and are “at bottom automatic.” (c) We have it on the authority of the late Dr. W. B. Carpenter, F.R.S., that “the intestinal tube from the stomach to the rectum is not dependent upon the nervous centres either for its contractility or for its power of exercising it, but is enabled to propel its contents by its own inherent powers.” (d) So also of the uterus, the contractions of which are not due to a reflex activity of the spinal cord, but to its own inherent power of contraction; parturition having taken place after destructive injury and paralysis of the cord, and even after somatic death. (e) In these cases, also, the nerve would seem to be useless as the ally of the muscle, but would play an important part in controlling and regulating, by antagonizing, its contractile energy.

I must notice, in this connection, an observation of Dr. M. Foster regarding the bladder. He says: “The escape of the fluid [from the bladder] is, however, prevented by the resistance offered by the elastic fibres of the urethra, which keep the urethric channel closed. Some maintain that a tonic contraction of the sphincter vesica aids in, or, indeed, is the chief cause, of this retention. The continuity of the sphincter vesica with the rest of the circular fibres of the bladder suggests that it probably is not a sphincter, but that its use lies in its contracting after the rest of the vesical fibres and thus finishing the evacuation of the bladder. On the other hand the fact that the neck of the bladder can withstand a pressure of twenty inches of water so long as the bladder is governed by an intact spinal cord, but a pressure of six inches only when the lumbar cord is destroyed or the vesical nerves are severed, affords very strong evidence in favor of the view that the obstruction at the neck of the bladder to the exit of urine depends upon some tonic contraction maintained by a reflex or automatic action of the lumbar spinal cord.” (f) But this experiment admits of a very different inference. We have just seen, on the authority of Dr. M. Foster, that section of the chief motor nerves of the stomach

(a) Dr. L. Brunton.

(b) Phys. pp. 346, 347.

(c) Phys. p. 348. (d) Hum. Phys., p. 410.
(e) Ib., pp. 979 and 980. (f) Phys., p. 448.