

But it must equally be allowed that some exceedingly close relationship does exist between them, for if a current of electricity be passed along a motor nerve, even for a part of its course, contraction of the muscles supplied by that nerve is the result. If an afferent nerve be experimented upon the same way, whether a nerve of common sensation, the optic, auditory, gustatory, or olfactory, a pricking sensation is experienced, flashes of light seen, sounds heard, a peculiar taste, or a phosphoric odor perceived, in accordance with the function of the nerve operated upon.*

Now if in the case of the magnetization of a bar of iron by the passage of a current of electricity round it, a conversion of the electric force into the magnetic be conceded, such connection can scarcely be denied in these cases in which a perfect parallelism to that of the magnetization seems to exist. But to follow out the analogy—for magnetism will under the proper conditions produce electricity—the converse should hold, namely, that the nerve force will produce the electric; and this is seen in the most remarkable manner in the case of the electric fishes of which the *Torpedo*, the *Gymnotus electricus*, and the *Silurus electricus* are best known. In them a special division of the nervous system is set apart for the production of nerve force, which by means of a particular form of apparatus—supplying the special material substratum required in this case—is converted into electricity. That in this case the nerve force is in fact converted into electricity, or bears some very analogous relation to it, is as well capable of proof as that in other cases it excites the contraction of muscles, for from the electric lobe proceeds a large nerve trunk, which when it reaches its destination in the electric apparatus, divides into minute branches which ramify profusely in all directions. Now if this nerve be divided, the apparatus fails to evolve electricity; if partly divided or injured, the discharge is weakened; if the electric lobe be removed, destroyed, partially taken away, or injured, similar results follow; and if the lobe be irritated the discharge is increased. If now the nerve be divided, and the cut end belonging to the peripheral extremity be acted upon by electricity, mechanical irritation, chemical re-agents, or heat, the result will be a passage of *nerve force* along the trunk of the nerve, and an evolution of *electricity* from the apparatus.

It will be observed that by reading motor centre for electric lobe, and muscle and muscular force, or motion, for electric apparatus and electricity, all the phenomena connected with a motor nerve centre, a motor nerve trunk, and a muscle, in their relation to one another, will have been given in the above description. It is, however, probable that there is a great difference between the relation that nerve force bears to electricity in the one case, and to the motion produced in the other. For whereas in the case of the muscle the nerve force is certainly not converted *directly* into motion, but bears a more distant relationship to it, as we shall see further on; on the other hand in the case of the electric fish it is highly probable that the electricity is developed directly from the nerve force by the conversion of the latter into it, at least the extreme exhaus-

* For the facts in this paragraph as well as for several others of the same kind further on, I am indebted to Dr. Carpenter's article in the Phil. Tran. for 1850 on "The mutual relations of the Vital and Physical forces."