driven by hand or by a motor. Sparks from four to eight inches long are taken from the two terminals into parallel conductors having high resistance. These resistances consist of long, thin strips of cloth moistened with salt solution. These lines spark to ground contacts, which are about fifty feet apart, in the yard outside.

A thin wire is bent into a series of sharp right angles. This wire may be looped into either the positive or the negative line. Photographic plates inclosed in hard rubber holders are placed at these angles. Some of them are exposed to the wire on the ground side of the angle, and some on the machine side. Their distance must be so adjusted that they give symmetrical results when the spark discharge around the angles is reversed.

With the negative discharge the plates on the ground side of the angles are much more strongly fogged than those on the machine side. Negative electrons having a mass of about one one-thousandth of that of the hydrogen atom leave the wire at the angle, because they can not turn the corner. They pass on through the cover of the hard-rubber holder, which may be three sixteenths of an inch thick, and fog the plate, which is developed in the ordinary way. These particles have momentum. They have energy of motion. They are a component of matter, as is well established by radio-active phenomena, and by well-known electrical experiments.

When the wire having these angles is looped into the line from the positive side of the machine this effect is also observed, but it is very much feebler. With a cover to the holders one sixteenth of an inch thick, 9,000 spark discharges in the positive line produce about the same intensity of image as is obtained with a single spark in the negative line. And here the effect is vastly stronger on the machine side of the angle than on the ground side. The negative electrons are therefore doing the work in the positive line also. They flow through this line from the ground to the machine. But they are not forced in under pressure, as they are forced out from the machine on the negative line. It is these little particles of negative electricity which constitute the electric current. They have kinetic energy which they impart to the conductors through which they are beating their way. In an arc light they plunge across from the negative carbon to the positive carbon. Their impact upon the positive carbon results in the formation of a crater which is intensely heated. About 85 per cent. of the light comes from this crater in the end of the positive carbon, which is, as has long been known, more than 1,000 degrees centigrade, or 1,800 degrees Fahrenheit, hotter than the negative carbon.

In order to obtain the results here described electrical oscillations must be prevented. This is attained by means of the moistened strips of cloth. When this has been accomplished the sparks are large and brilliant at the negative end in both positive and negative lines, and thin out towards the positive end. The negative terminals are large spheres of about 10 cm. diameter. The positive terminals are small knobs, of about 1 cm. diameter. While on the large spheres the electrons repel each other. But when they start into motion across the spark-gap, they attract each other electromagnetically. This appears to be the reason why the spark thins out as the electrons proceed in their motion across the spark-gap. A "fat" spark is a sure indication of an oscillating discharge.

The fact that sharp shadow pictures are formed of any thin object like a glass slide lying on the photographic film under the wire, shows very clearly that these effects are due to a cathode discharge. Whether or not X-ray effects are also involved, is still an open question.

Arrangements are now being made to place the angle-wire in a vacuum tube. This may perhaps render these momentum effects visible.

Francis E. Nipher

SPINAL SHOCK: A PRELIMINARY NOTE

A few months ago, the writer, in conjunction with Professors G. N. Stewart and C. C. Guthrie, stated his belief that the cause of spinal shock lies solely in the interruption of the long conduction pathways of the spinal cord.[1] Experiments which were then in progress have been extended until still more of the details of spinal shock following anatomical transection of the cord have been duplicated (1) by the method of cerebral anemia described in the paper cited, and elsewhere, and (2) by freezing the spinal cord with a spray of ethyl chloride or by the direct application of liquid air. Freezing the brain as a means of stopping the reflexes was probably first done by Professor D. J. Lingle (unpublished experiment on frog). Practically all of the effects observed after anatomical rupture of the conduction pathways may be observed when either of the other methods is employed, if the time limits be kept the same when comparing the results of the different methods. We called attention in a previous paper to the fact that strychnine spasms might appear immediately after the beginning of cerebral anemia, or at any time during which the reflexes of the skeletal muscles are absent. I have since shown that, in a curarized animal, strychnine does not cause the return of vaso-motor reflexes in "shock" sooner than they would appear under the usual conditions of the experiment.

The evidence for my views, drawn as it is from a laborious study of the phylogenetic development of the function as well as the structure of the central nervous system, can not be presented here. Nor is this the place to develop my hypothesis of the return of the reflexes after interruption of the long pathways, which depends upon facts of the same nature. Both hypotheses will be developed in detail in later papers. It will be sufficient to point out here that, in my opinion, the real problem is to explain the return of the reflexes after injury to the brain or spinal cord, and that a simple solution to both problems lies in the application of the general principles of organic evolution to function as well as to structure.

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[1] Pike, Guthrie and Stewart, *American Journal of Physiology*, 1908, XXI., p. 359. See, also, Rosenthal and Mendelssohn, *Neurologisches Centralblatt*, 1897, XVI., 978.

A NEW SPECIES OF THE GENUS MOROPUS

SINCE the fall of the year 1904 the Carnegie Museum has carried on extensive excavations in a quarry near the Agate Spring Stock Farm on the Niobrara River in Sioux County, Nebraska. The work has resulted, among other things, in the recovery of an almost perfect skeleton of an adult specimen of *Moropus elatus* Marsh, which will shortly be mounted and exhibited, and upon which the writer intends in the early winter to publish a memoir giving a full account of the osteology of this great mammal. Among the material collected are a number of bones representing the remains of another species of the same genus to which, in honor of my esteemed colleague, Mr. O. A. Peterson, I propose to apply the name *Moropus petersoni*. A more detailed description, accompanied by figures and plates, will be published in the forthcoming *Memoir*. For the present I content myself with the publication of a brief diagnosis wherein are pointed out some of the differences which distinguished this species and permit of its separation from *Moropus elatus* Marsh.

Moropus petersoni, sp. nov.

Adult. Considerably smaller in size than *Moropus elatus*. The dentition, so far as ascertained, does not materially differ from that of the larger species. The top of the cranium is not, however, characterized by a sagittal crest as is the case in *Moropus elatus*. In order to understand the difference between the two species the accompanying somewhat diagrammatic figure, representing the posterior portion of the top of the skull of the two species, is given. It will be seen that the narrow elevated ridges marked *aa* do not converge on the median line in *Moropus petersoni* as they converge upon the skull of *Moropus elatus*. It will further be observed that the interparietal bone *ip* in *Moropus petersoni* is quadrate in form, whereas in *Moropus elatus* it is subtriangular in form. The cervicals in *Moropus petersoni* are less massive; the fore limbs are proportionately slenderer; the scapula is relatively longer and narrower than