

ammonia were given off on applying the heat. As soon as the evolution of this gas had ceased, the alcohol was distilled off and the residue treated with a considerable excess of hydrochloric acid. This was then heated gently as long as acid vapours continued to be evolved, digested with absolute alcohol, and filtered, and then the filtrate was evaporated to dryness. The dry mass thus obtained was treated several times with alcohol in a similar manner. The result of these repeated digestions was then dissolved in water, and a few drops of a solution of nitrate of silver were added to it, which occasioned a slight precipitate of chloride of silver. This was separated by filtration, and the filtrate was exactly neutralized with ammonia. On adding excess of nitrate of silver to this, an abundant white precipitate was obtained, very soluble in nitric acid and ammonia. This gave, on analysis, numbers agreeing very well with the composition of succinate of silver. The acid itself possessed also all the properties of succinic acid. It sublimed on the application of heat, was soluble in water, alcohol, and ether, and gave, when neutralized, a reddish-brown precipitate with perchloride of iron. Moreover, on digesting this precipitate with ammonia, an acid could be detected in the filtered liquor, which gave white precipitates with nitrate of silver, and with a mixture of chloride of barium and alcohol.

Succinic acid *can* then be obtained from glycol in the same manner as propionic acid from ordinary alcohol; the bromide of ethylene, the point from which I started, being capable of derivation from the diatomic alcohol.

I propose extending this investigation to some other hydrocarbons of the series $C_n H_n$, with the view of ascertaining whether or not the homologues of succinic acid can be obtained from these bodies by a similar process.

IV. "Results of Researches on the Electric Function of the Torpedo." By PROFESSOR CARLO MATTEUCCI of Pisa. In a Letter to Dr. SHARPEY, Sec. R.S. Received August 3, 1860.

(Extract.)

"It has hitherto been believed that the action of the electric organ of the Torpedo was momentary only;—that it becomes charged

under the influence of nervous action and discharged immediately that action ceases, somewhat like soft iron under the influence of an electric current. Such, however, is not the real state of the case. The electric organ is always charged. It may be conclusively shown by experiment that the action of that organ never ceases, and that round the body of a Torpedo, and probably of every other electric fish, there is a continual circulation of electricity in the liquid medium in which the animal is immersed. In fact, when the electric organ, or even a fragment of it, is removed from the living fish and placed between the ends of a galvanometer, the needle remains deflected at a constant angle for twenty or thirty hours, or even longer.

“I must here explain that in electro-physiological experiments it is highly advantageous to employ, as extremities of the galvanometer, plates of amalgamated zinc immersed in a neutral saturated solution of sulphate of zinc. This arrangement, which can be worked with the greatest facility, gives a perfectly homogeneous circuit, leaving the needle at zero in an instrument of 24,000 coils; the liquid in contact with the animal part experimented on has the greatest possible conductibility while it does not act chemically on the tissue, and the apparatus is entirely free from secondary polarity.

“To return to the Torpedo. The electric organ, or a portion of it, detached from the fish and kept at the temperature of freezing, preserves its electromotive properties for four, six, or even eight days; and an organ which has been kept for twenty-four hours in a vessel surrounded with a frigorific mixture of ice and salt, is found to possess an electromotive power as great as that of the organ recently detached from the living fish. Thus the electric organ retains its functional activity long after both muscular and nervous excitability have been extinguished.

“What then is the action of the nerves on this apparatus? Here again experiment affords a very distinct and conclusive answer. Detach the organ of a live torpedo and cut it into two equal portions, in such a way as to leave each half in connexion with one of the large nervous trunks; place the two halves on a plate of gutta percha, with electric couples opposed; that is, with the similar surfaces (say the dorsal) in contact; and connect the two free (ventral) surfaces with the extremities of the galvanometer. There will usually be no deflection of the needle, or, at most, a very slight effect which will

soon disappear. Now, after having opened the circuit of the galvanometer, irritate the nerve of one of the segments, by pinching, by the interrupted electric current, or in any other way; or prick the piece itself with a needle. The portion of organ thus stimulated will give several discharges in succession, and a rheoscopic frog's limb with its nerve applied to the part will each time be thrown into violent convulsions. If, after this, the galvanometer be applied as before, there will be a very strong deflection in a direction answering to the segment stimulated. This deviation endures for a short time, but gradually becomes less, so that in a few minutes the effect of the two segments is equal. Stimulation now of the other segment will in like manner render its electricity predominant. These alternations may be repeated several times, but naturally the effect becomes less and less marked.

"Thus the electromotive apparatus becomes charged and acts independently of the influence of the nerves, but that influence renews and renders persistent the activity of the apparatus. We know, moreover, that the discharge, which is only a state of temporary increased activity of the organ, is brought on by an act of the will in the live animal, or by the excitation of the nerves of the organ.

"I shall not enter now into further details respecting my recent experiments on the Torpedo, but I venture to think that we have really made a step towards clearing up the theory of the animal electromotive apparatus. The organ of the Torpedo does not, under the influence of the nerves, act as an induction apparatus; the operation seems more analogous to that of a 'secondary pile,' created, through the influence of the nerves, in each constituent cell of the organ.

"The case is very different in muscular action, the changes occurring in which are better understood now that we know the phenomena of muscular respiration. I do not here refer to the variation of the muscular current which takes place at the moment of contraction. In that case it would appear from experiment, as I lately showed, that there are indications of a current in an opposite direction; but the conditions of the animal structure in action are so complex that no inference can be drawn as to the intimate nature of the phenomenon. It is otherwise, however, in comparing muscles which have been left at rest with muscles which have been fatigued by repeated contraction. Being still engaged in the investigation of

this matter, I shall content myself now with mentioning one result of my inquiry, which I consider as well established ; the result, in fact, of performing on muscles the same kind of experiment as the one above described on the organ of the Torpedo. The experiment is as follows :—Having selected a series of muscles, entire or divided, which have been proved (by my method of opposed muscular piles) to be equal in electromotive power ; subject a certain number of them to repeated stimulation, and then, by means of the method of opposed couples, compare the muscles which have been exercised with those which have been left at rest, and it will be found that the latter will manifest a much greater degree of electromotive power than the former. The nervous excitation, which causes muscular contraction, develops heat, generates mechanical force and consumes chemical affinity ; and as the electromotive apparatus of muscle operates through means of that affinity, it must get weakened, like a pile in which the acid has become weaker. In the Torpedo, on the other hand, there is neither heat nor mechanical force produced, and the electromotive apparatus is set up again, as it were, through the influence of the nerves, after the manner of a secondary pile.”

V. “Natural History of the Purple of the Ancients.” By M. LACAZE DUTHIERS, Professor of Zoology in the Faculty of Sciences of Lille. Communicated by Professor HUXLEY. Received March 22, 1860*.

The purple dye so esteemed by the ancients has by turns excited the curiosity of naturalists and of historians. The number of memoirs upon the subject is considerable, and they are to be found in almost all tongues. However, in all these works, remarkable in many respects, and which cannot be analysed in this short notice, three deficiencies are to be noted regarding matters of very great moment in the history of this substance.

What are, 1st, the producing organs ? 2ndly, the nature ? 3rdly, the natural primitive colour of the dye ? It is difficult to give any answer to these three questions by means of the facts contained in existing memoirs. It is for the purpose of replying to them that I

* Translation received August 22, 1860.