

down to us,"¹ and that "even his autographs are exceedingly rare."

It is of interest, therefore, that another letter in the hand of Lamarck has been discovered in Paris (it is now in my possession), and as it contains several data regarding his life, it may be worthy of publication. It reads as follows:

PARIS ce 16 floréal au 5 de la Rep.
Lamarck professeur au Museum d'hist. naturelle
Au Citoyen Cyalis Lavaux Directeur de la
1^{re} division des domaines

Citoyen

ayant reçu de Songeons, département de l'oise, l'avis que la vente des biens que j'ai Soumissionnés étoit Suspendue et qu'on avoit méconnue l'autorité du Ministre des finances, j'ai eu l'honneur de vous faire passer une lettre par laquelle je me Suis plaint de la Conduite du département à cet égard. j'apprends en ce moment que la personne qui m'a fait passer cet avis m'a trompé, et que le département de l'oise n'a encore pris aucun arrêté qui me fut préjudiciable. je me hâte de vous en instruire pour vous prier de ne donner aucune Suite à la lettre que j'ai eu l'honneur de vous faire passer.

quand le Ministre de l'intérieur aura fait passer à Son Colleague le Ministre des finances les Conditions de la vente de ma Collection, je me recommande à votre bienveillance que vous avez déjà bien voulu me promettre, et pour laquelle je vous prie d'agréer ma vive reconnaissance et mes Salutations fraternelles.

LAMARCK

It will be seen from the above details that Lamarck, like many members of his class, was troubled in matters of property during the upheaval of the revolution. He had maintained his post, poor as it was, in the Jardin des Plantes in 1790, and had made a strong plea for a reorganization of this institution under the republican régime: he had even (1793) gained the day and during the most democratic epoch, he was distinguished as one of the first professors placed in charge of the collections of the Jardin des Plantes. The present letter shows, none the less, that in 1794 Lamarck was concerned about his property at Songeons.

¹ "Lamarck le Fondateur du Transformism," 1909, p. 105.

The authorities had not, however, as he later ascertained, confiscated it, and ordered its sale. Still, times were bad and he was probably in financial straits, since he took the opportunity in the same letter to refer to the matter of the sale of his (private) collection, and to "pull a wire" more or less insistently.

BASHFORD DEAN

SPECIAL ARTICLES

THE APPARENT ANTAGONISM BETWEEN ELECTROLYTES AND NONCONDUCTORS

1. In a publication contained in *SCIENCE*, Vol. XXXIV., No. 887, pp. 928, Sumner makes the following statement: "Loeb's assertion that 'salts alone have such antagonistic effects' certainly does not apply to adult fishes. I need only call attention to the fact that cane-sugar solutions of certain strengths were found by me to very clearly defer the fatal action of the copper salts, both upon *Fundulus heteroclitus* and upon certain fresh-water species."

Thirteen years ago I pointed out the fundamental difference between the influence of electrolytes and nonelectrolytes upon life phenomena and in later publications called attention to the fact that this difference indicated an interaction between the electrolytes and colloids, especially the proteins, of the cells, which did not exist between nonelectrolytes and the same colloids of the cells. The further development of colloid chemistry and biology has shown that this conclusion was correct and fruitful. The fact that the toxic action of electrolytes upon the cells can be antagonized by electrolytes only is a special case of this more general rule. In 1902 Gies and I published an apparent exception to this rule, namely, that the toxic action of ZnSO_4 upon *Fundulus* eggs could be inhibited through the addition of cane-sugar; but we pointed out that in this case there is no antagonistic action between ZnSO_4 and cane-sugar in regard to the colloids of the egg (or membrane) but a chemical reaction between ZnSO_4 and cane-sugar which leads to the formation of zinc saccharate, and consequently to a diminution of the Zn ions in solu-

tion. Five years later Sumner published his observations that the action of copper salt can be deferred through the addition of cane-sugar, which is of course similar to the observation by Gies and myself. In the case of the antagonization of ZnSO_4 by another electrolyte we are, however, dealing with the action of both electrolytes on the same colloid.

2. Sumner states also that distilled and fresh water are toxic for *Fundulus* and that there exists an antagonism between distilled water and salts for these fish. The fact that a number of *Fundulus* can live a long time (if not indefinitely) in distilled water and that these fish, if they become landlocked, can live indefinitely in fresh water indicates that the distilled or fresh water are not in themselves toxic for these animals but that the toxic effect occasionally (but not always) observed is due to an inconstant or quantitatively varying constituent of the water. This constituent may be a parasite, or it may be a substance given off by the fish itself, *e. g.*, CO_2 . Wasteneys and I have recently found that CO_2 may produce the same changes on the skin and the gills of the fish as those produced by mineral acids; and that, as in the latter case, the etching effects of the CO_2 may be counteracted through the addition of a neutral salt. The beneficial effect of the addition of some salt to the fresh or the distilled water, therefore, indicates that the salt either kills certain parasites contained or developed in the distilled water, or antagonizes the toxic effects of some electrolyte, *e. g.*, carbonic acid, if its concentration exceeds a certain limit, as it possibly did in some or all of Sumner's experiments.

JACQUES LOEB

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THE PERMEABILITY OF PROTOPLASM TO IONS AND
THE THEORY OF ANTAGONISM

EVIDENCE was recently presented which showed¹ that a great variety of salts readily enter living cells and that antagonism between salts may be due to the fact that they mutu-

ally hinder or prevent each other from penetrating the protoplasm.

In these experiments plasmolysis was the criterion of penetration. Plasmolysis shows which salts enter and how rapidly, but does not indicate whether it is the ions or only undissociated molecules which penetrate the cell. To decide this question experiments were performed to test the electrical conductivity of living tissues in various solutions. The results agree in showing most conclusively that ions readily penetrate living protoplasm and that many ions which penetrate quite rapidly in pure solutions may be hindered or prevented from going in by the addition of small amounts of CaCl_2 or other salts.

To obtain reliable results in conductivity experiments material should be used which is not injured by weak currents or by other experimental conditions. It is desirable that the amount of space between the cells be constant so that the current which passes between the cells may be a constant fraction (as small as possible) of that which actually traverses the living protoplasm. The current should pass through a large number of thin sheets of living tissue, separated by thin films of solution. The penetration of various ions may then be studied by merely changing the solution. If the material is in thin sheets the ions are forced by the alternating current to pass in and out of a great extent of protoplasmic surface; this is of great importance, since the larger the surface the more reliable the measurement. The sheets of living tissue should be sufficiently rigid to permit manipulation and to endure without injury pressure sufficient to pack them firmly together so that the films of solution which separate them may be as thin as possible.

All these conditions are admirably fulfilled by the common kelps of the Atlantic coast (species of *Laminaria*). This material was accordingly used throughout the investigations.

Disks about 13 mm. in diameter were cut from the fronds by means of a cork-borer (the average thickness of the frond was about 0.5 mm.). From 100 to 200 of these disks

¹ SCIENCE, N. S., 34: 187, 1911.