may call conveniently this whole process: *origin of species.*

I then proceed to characterize these four factors, which are the following: (1) variation; (2) inheritance of variations, 'consanguinity becomes morphologically visible'; (3) natural selection, acting upon the material produced by variation and inheritance, improving the average, and causing, under certain circumstances, 'mutation';[5] (4) 'bionomic separation' (p. 190, *l. c.*), forming what we call 'species.'

The four factors named, *variation, inheritance, selection* and *separation*, must work together in order to obtain different species; * * * it is impossible to think that one of them should work by itself, or that one could be left aside.

I have further demonstrated in the paper referred to, that Darwin already held practically the identical opinion, although he did not properly recognize 'bionomic separation,' and introduced, in its place, the 'principle of divergence.' In the face of this fact, it is only to be regretted that bionomic separation or habitudinal segregation has not received due attention, and is generally not understood in its true meaning by those that have little experience in field work; indeed, it is impossible to get an appropriate idea of it in the museum or the laboratory, and also the botanical garden is entirely unfit to bring home its significance. I hope, however, that its real value and real meaning will become more generally known by and by. For those that have no chance to convince themselves in nature of the ever-presence of bionomic separation, the study of Gulick's book will be advantageous.

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## *SPECIAL ARTICLES.*

### Reactions in Solutions as a Source of E.M.F.

Permit me to call to the attention of the readers of this journal certain observations which I have recently made relative to the chemical reactions in solution as a source of the electric current. So far as I am informed the phenomenon described below has not previously been recorded.

Some time ago, while carrying on a series of experiments upon photo-electric effects, certain features of the investigation led me to suspect that *any* and *all chemical reactions* give rise to a *measurable* quantity of electrical energy.

In order to test this I introduced into a very small glass vessel two platinum wires, No. 26, to serve as electrodes. These electrodes were as nearly identical in dimensions as it was possible to make them. They extended down into the cell about two centimeters, at a distance apart of, perhaps, two millimeters. The cell thus constructed held approximately 3 c.c. The electrodes were then connected by means of a short wire to a sensitive galvanometer.

About 2 c.c. of silver nitrate solution (5:25) were introduced into the cell. Two or three drops of concentrated HCl were then added to the silver solution in the cell. Immediately when the acid came in contact with the salt a decided deflection was manifest on the instrument. Stirring the reacting bodies increased the deflection and at times reversed the direction of the current. The maximum deflection was about twenty-five scale divisions.

At first the acid was introduced *between* the platinum electrodes. Later it was found that if the reagent was allowed to come in contact with the silver solution *about* either *one* of the electrodes the direction of the resulting current, as indicated by the galvanometer, could be predicted, *i. e.*, the current *in all cases* left the cell by that electrode about which the reaction was taking place *least* vigorously.

Different concentrations of the salt and acid were tried. It was found that the deflection of the needle was roughly proportional to the concentration of the reacting bodies. It was also observed that the current ceased when the reaction was complete, which, when the solution was not stirred, took at times a minute or more.

Other combinations were tried as follows: NaCl and $H_2SO_4$; BaCl and $H_2SO_4$; $CuSO_4$ and $NH_4OH$; KOH and HCl. Each of the above reactions gave rise to a decided deflection of the needle, the current continuing

[5] Not the 'mutation' of de Vries, which term is decidedly ill chosen, being preoccupied long ago by Waagen, Neumayr and W. B. Scott, and used in an entirely different sense.

until the reaction was completed. The most decided deflection of the instrument occurred in those cases where the reagent was permitted to act more vigorously about *one* electrode than the other.

To test as to the possibility of the phenomenon being due to a difference in concentration at the electrodes, the cell was nearly filled with water and a saturated solution of NaCl was introduced into the water about *one* of the electrodes. While a very slight deflection of the needle was manifest, it was not in any case comparable with the result mentioned above, being not greater than one scale division.

Another possibility is, of course, a thermal effect. To test this the cell was again filled with water and concentrated $H_2SO_4$ was introduced about *one* of the electrodes. A slight deflection was noted—in magnitude about the same as in the last-mentioned case, one scale division.

In addition to the above evidence against a possible thermo effect might be mentioned the fact that the magnitude of the current did not appear to be a function of the heat of reaction.

The above would seem to indicate that the current is not due to a difference in concentrations at the electrodes or to a thermo-effect. However, the data at present at hand would scarcely justify a definite conclusion in this respect.

As to the ultimate cause of the current observed I am not at the present writing prepared to venture an opinion. I make this communication in order that other investigators may test the matter for themselves.

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## PEAR-LEAF BLISTER-MITE (ERIOPHYES PIRI NAL.).

As with many of our orchard pests, this is an introduced species, and was undoubtedly brought into the United States in importations of nursery stock. Since its introduction it has, largely through the nursery trade, been widely distributed in the pear-growing sections, where it is usually a familiar pest of this kind of fruit. Within the past few years added interest has been shown towards this species in this state because of its attacks upon apple foliage. In 1902 the attention of this station was directed to its work in two widely separated orchards, but during the past two years it has been very conspicuous in many orchards in various parts of the state where it promises to be an important pest of this fruit.

In the study of the habits and distribution of *Eriophyes piri* in the state of New York, two other European species have been found upon pear and apple leaves. These have been recorded by Dr. Nalepa by the names of *Epitrimerus piri* and *Phyllocoptes schlechtendali*. The latter are distinguished from *Eriophyes piri* in that the abdominal rings on venter are nearly twice as many as on dorsum. *Epitrimerus piri* differs from *P. schlechtendali* by having two longitudinal furrows on dorsum of abdomen. The former is found upon apple and pear leaves, while the latter has so far been detected only on apple foliage.

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## *QUOTATIONS.*

### THE METRIC SYSTEM.

THE American people have a world-wide reputation for their ingenuity in devices to save time and labor. It is an anomaly that such a progressive people has failed to see the enormous loss of time and labor incurred in the retention of medieval and confusing weights and measures.

Three fourths of the enormous foreign trade of the United States last year was with countries having the metric system—the system now in use among four hundred and fifty millions of people. Merchants import liquids by the liter, textiles by the meter, foods and drugs by the kilogram, and the innumerable consignments must be calculated into and sold by different measures of volume and of length and by avoirdupois weight and troy weight and apothecaries' weight. In exporting commodities, on the other hand, quantities, weights and measures must be laboriously converted