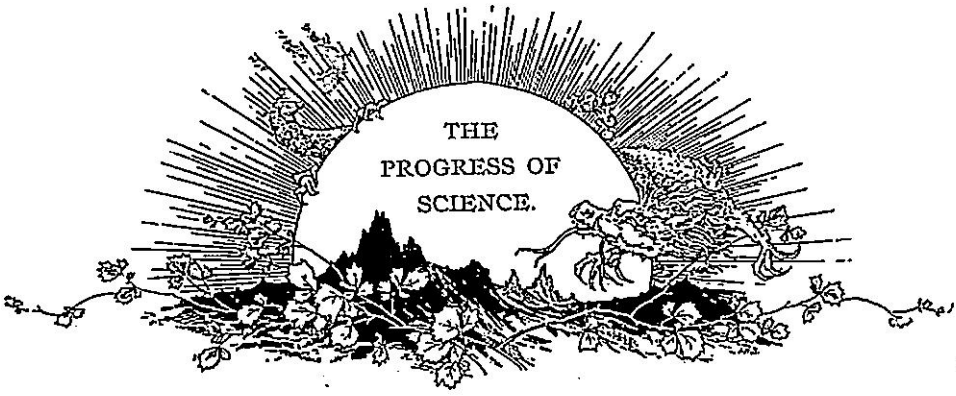


ON THE NATURE OF ELECTRICITY.

IT is practically impossible for scientific thinking to get along without some hypothesis, and a poor one known to be inadequate, or even radically wrong, is better than none at all, and there are many such in scientific literature to-day. The phenomena of electricity have been a constant challenge to the ingenious philosopher. At first they were supposed to be due to imponderable fluids. Franklin's theory supposed but one, the positive and negative conditions being due to a greater or less than the normal quantity. Dufays required two fluids, a positive and a negative. Heat and light were likewise thought of as imponderables, a word which served to shelter ignorance and was as good as abracadabra. For light and heat the doctrine broke down on the discovery and proof that one was but a wave motion in the ether, while the other was a vibratory motion of atoms and molecules, and since then electrical theory has been almost as various as philosophies in other matters. By some it has been thought of as rotations of matter, by others as vibrations in the ether. Some have thought it must be the ether itself. One eminent one, Dr. Lodge, has ventured to suggest that after all there is no such thing, and that the word electricity may likely drop out of the science as the word light may. Lastly, some who have been unable to find any consistent theory have become electrical agnostics, and like E. du Bois-Reymond cry out "Ignorabimus!" leaving no chance for the coming man to be wiser than they.

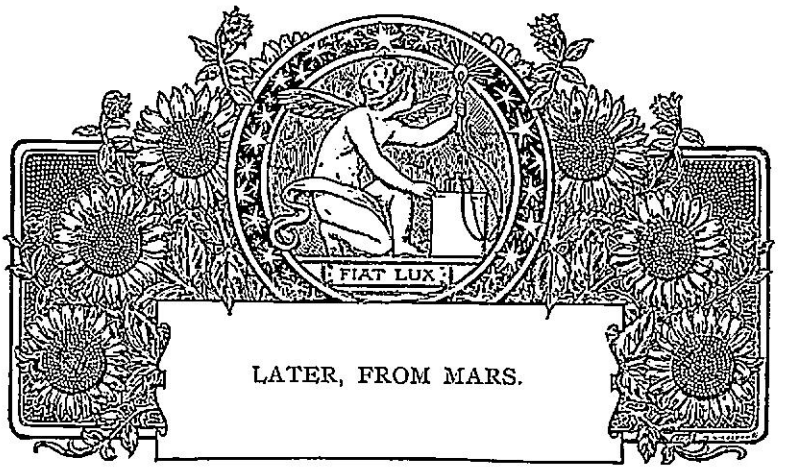
Nevertheless, there is a steady growth in knowledge which gives good ground for thinking we yet may know as much about the nature of electricity as we do of heat and of light, and knowledge of these is now very definite.

When it was discovered that an electric spark—which is a transient electric current—would not pass through a vacuum, that it would jump three feet in the air rather than bridge the eighth of an inch where there was no conducting material, it became apparent that empty space was a perfect non-conductor of electricity, nevertheless, by a process called induction, one body may become electrified by the mere presence of another electrified body without contact with it, just as a body may be heated by another body without contact.

Many have not yet become acquainted with what has been in the text-books for twenty years about heat and so-called radiant energy, and therefore continue to talk and think about heat waves and light waves as if they were different things, whereas radiant energy, whether in long waves or short waves, is neither the one nor the other, both are transformed heat motions, therefore are no longer properly called heat. Heat is a condition of ordinary matter, namely, vibratory motion of atoms and molecules. Radiant energy is similarly a condition of the ether, namely, wave motion of any period, each may be the antecedent of the other.

The electro-magnetic theory is now as well established as is any physical theory, and that implies that ether waves, long or short, have their origin in the movements of matter of one size or another, hence in electrical phenomena we have to consider two different classes of effects: one in matter, the other in ether, which is the result of the first. One thing is certain, electricity never manifests itself except when there is some mechanical disturbance in ordinary matter, and every exhibition of electricity in any of its multitudinous ways, may always be traced back to a mass of matter. Some have confined their attention to what takes place in matter, and have called *it* electricity; others have had regard to what takes place in the ether, and have called *that* electricity; others have hopelessly confused the two. It cannot be proper to call a condition of things in matter and the condition of things in the ether, which is a result of it, by the same name, and this is now the chief reason why there is confusion.

A. E. DOLBEAR.



LATER, FROM MARS.

SINCE our last note, several interesting communications have appeared with respect to Mars. From the Lowell observatory, in Arizona, Mr. Lowell himself reports that about a dozen of Schiaparelli's "canals" had been recognized two months and a half before the summer solstice of the planet's southern hemisphere. Early in June, the white cap which surrounds the south pole had a diameter of forty-seven degrees, covering the whole of the planet's frigid zone. It diminished rather rapidly, maintaining an almost perfectly circular outline, bordered by a dark streak a hundred miles at least in width, which Mr. Lowell assumes to be water—a polar sea formed by the melting snow. Now and then bright, star-like points shone out upon the "cap" for a few minutes and quickly disappeared—interpreted as ice-slopes, so inclined as to give us, for the moment, a mirror-like reflection of sunlight. The great "dark rift," some twelve hundred miles long and two hundred wide, which, for a time, was so conspicuous in the polar cap two years ago, appeared again this season. Mr. W. H. Pickering, also at the Lowell observatory, says that the most important conclusion from their observations seems to him to be that Mars does not present the same appearance at the same season for two successive Martian years; and the differences are not confined to small details, but relate to "large and prominent features;" nor are they such as might be due to the seasons being a few weeks earlier or later one year than another.

Still more important, and very disconcerting to those of us who have been indulging the belief that Mars is essentially like the earth in its physical conditions, is the announcement by Mr. Campbell, of the Lick observatory, that the planet's spectrum gives no evidence of an atmosphere. On comparing the spectrum of Mars with that of the moon, when the two bodies were close together in the sky, he finds their spec-

tra precisely similar. Like earlier observers, he detected in the spectrum of the planet lines known to be due to oxygen and to the vapor of water; but they were no stronger than in the lunar spectrum at the same time; and, since we know that in the latter these lines are attributable simply to the action of the earth's atmosphere, the conclusion seems to follow that the planet in its atmospheric conditions is more nearly analogous to the moon than to the earth. If this should turn out to be really the case, it would seem that the so-called "ice-caps," "seas," and "lakes" must find a new interpretation.

It has always been felt as a difficulty that the planet's greater distance from the sun (on account of which the solar heat upon its surface is only about half as intense as what we get) renders the presence of liquid water a little unlikely. Then, too, the smallness of the planet's mass, and consequent diminished force of gravity, would tend to make its atmosphere less dense than ours, and to give it the climate of a mountain-top. But hasty conclusions are to be avoided.

C. A. YOUNG.

FROM the field of applied chemistry, several new products have recently come which are of great interest and promise to be of great value and importance. The detailed preparation of the new products cannot be here given, but it may be generally stated that they are derived from the compounds obtained by the action of carbon-disulphide on hydrated cellulose, this latter being made by the action of caustic soda on common cotton-wool or some cheaper form of cellulose. The new products referred to are chemically known as the thiocarbonates of cellulose or are certain modifications of these.

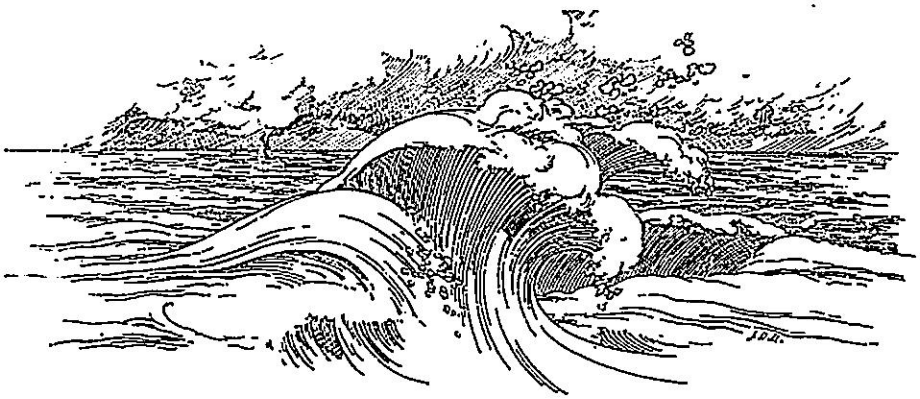
Several applications of the different forms of the new compound have been tried with results that promise wide usefulness, while the announcement of new and novel properties and new modifications of the compound are of frequent occurrence. A dilute solution of one of the derivatives has been successfully used as a substitute for glue in bookbinding, and a preliminary test indicates that it may prove an admirable substitute for this substance in carpentry. The colorless solution appears to be excellently adapted for sizing and stiffening cotton and linen cloths, and also for paper-sizing. Linen thus treated is soft and pliable in water, but becomes stiff and resumes a polished surface, without treatment with starch, upon being ironed. The solution can also be used as a mordant, carrying well the pigment with which it is mixed, and binding it tenaciously to the fiber of the cloth. From the solution, films of cellulose of various thickness have been prepared and used for photographic purposes, or for stamping into various small articles, as plates, trays, etc. These films of greater thickness, put upon cloth, form a sort of artificial leather, which appears to be well adapted for various kinds of upholstering, while the thickest sheets have been used as a substitute for wood-carpeting.

From the soluble form a dense mass of cellulose is readily obtained which resembles ebonite in appearance, is susceptible of a high polish, is homogeneous, and may be worked in any direction. This form is valuable as an insulator, and as a substitute for wood and metal in the manufacture of many small articles.

In all the above applications, the new compounds have the promise of a wide range of usefulness.

The compounds are the discoveries of Messrs. Cross, Bevan, and Beadle, English chemists. Mention of their discoveries and investigations has been made from time to time in various scientific journals, but the commercial applications of these discoveries have only recently been worked out and made known. To this result, Mr. A. D. Little, of this country, has largely contributed, and from his statement the above facts are mainly taken.

S. E. TILLMAN, PROF. U.S.M.A.



FOSSIL PLACERS OF THE TRANSVAAL.

THE Transvaal yielded nearly thirty million dollars' worth of gold last year, and the prospect is well assured that this product will be far surpassed by that of the coming years. Indeed, it will be surprising if this region does not prove more productive than California or Australia have ever been. In the Transvaal, as in other auriferous regions, there are veins and surface gravels, or placers; but here the main source of the gold lies in auriferous conglomerates. Such conglomerates of any commercial importance are known elsewhere only in Australia, and, even there, they are relatively insignificant.

According to a late report by Bergrath Schmeisser, the veins are found almost exclusively in much metamorphosed rocks of Silurian age. Overlying the Silurian unconformably is the Cape formation, comprising rocks ranging from the Devonian to the Carboniferous, and it is in the conglomerates of this series that the great supply of gold is found. The conglomerates contain pebbles from the size of a pin's head to that of a cocoanut, and most of them are quartz; but pebbles of other rocks occur, as well as rounded nodules of pyrite. Gold is found in stringers in the quartz, and the pebbles of pyrite are auriferous, as M. Delauny points out; but the greater part of the metal exists in the cement which, when fresh, is blue in color, ferruginous, and silicious. The coarser portion of the thinner conglomerate beds is the richest. There are many of these beds, and they, with other strata of the Cape formation, constitute a broad basin. Deep shafts and deeper borings show that the average amount of gold is not affected by depth below the surface. The total extent of the auriferous beds, called "reefs," is known to be enormous; and the yield can be estimated as well as that in a coal basin, i. e., with a very fair degree of approximation.

It seems clear that the reefs are neither more nor less than ancient placers, gravel deposits, consisting of detritus from veins in the Silurian rocks, which have been covered in by later deposits. They have been somewhat folded, and are faulted by intrusive dikes, while the cement has undergone induration. It would seem from the descriptions that sulphides of iron have formed or reformed in the cement, so that where the conglomerates are fresh and blue, the gold is en-

tangled in the sulphurets, and can be only very partially extracted by simple amalgamation. The concentrated sulphurets are treated by chloridation and other chemical processes. GEORGE F. BECKER.

SOCIOLOGY.

THE plea in favor of a comprehensive school of sociology is founded upon the forces which are locked up in what we call society. Society is not a caste of sex, culture, or birth. It comprehends all individuals in their inherent, spontaneous, and fixed inter-relations, especially as dwelling in community. It is evident that herein are imbedded and chained beneficent and destructive energies; armies mass themselves and deploy in this field. Their intentions and results are as inscrutable, in spite of all history, as the combination of manifold wills would lead one to surmise. They may slumber, or be kindled instantly into ungovernable fury, by an unimaginable impulse. They are for good or for evil. Can there be a realm more weighty and extensive for knowledge? Theology in its narrow sense, natural science and anthropology have had their day; the study of society should now follow. Its moral capacities are of greater significance than steam, light, or electricity; and if these have been worthy of systematized study and investigation, how much more ought those spiritual agencies to be made the subjects of a university discipline.

We may find a second argument in the very condition of the social sciences. They stand in isolated positions with only accidental bonds of union. There is no substantial unity in the method of pursuing them. There has been all too little speculative philosophy concerning them, and still less of a genuine presentation of their history. Moreover, there is, in some respects, a necessary confusion between the political and social sciences on the one hand, and certain empirical professions on the other. Again, some insist on treating them from a biological point of view; others vibrate between an economical psychological and theological outlook.

Sociology itself is a term so very variously used, that many are constrained to doubt its claims to being a science at all. What can unravel these tangles save a centralized and unified plan of study? Is not a professional school essential to the freedom, dignity, and enlargement of this branch of knowledge?

But our science is also extraordinarily practical; it is converted almost immediately into an art; its applications are on the instant. There are evils to be rectified, there are beneficent movements to be wholesomely directed. It is a science of moral relief, improvement, progress. It is no wonder, then, that it appeals so directly to our sympathies, for it concerns human nature and its weal. Most of its activity springs from our emotional qualities. There is the strongest link between the mind and the affections in determining its principles and laws. Surely a school, with its machinery of research and instruction, is best adapted to discover the subtle nexus of thought and love, of individualism and altruism.

There is also a call for disciplined powers in the administration of society. The quick response of men to human needs and ills, has led to a surplus of organizations, which trench upon one another's ground; material is duplicated and so wasted. This is true in every province of sociology, and hundreds of hairbrained men and

women find their function in these associations, much to the detriment of science, and still more to the marring of happiness for those who ought to be helped. The church makes its experiments, the state and municipality follow; the voluntary corporations move exactly on the same lines. Does it not stand to reason that there is need of disciplined men and women, who combine a general culture with special training in sociology, that this perversion and waste may be obviated? And where can the education be obtained, save through an organized professional school?

The call is accentuated by existing social disorders. Certain evils in family life, hostility between capital and labor, questions of caste, immigration population, unsettled points in the branches of economics, the increase of crime and vice, persistent socialistic aims for improving the material aspects of life,—all these leave us no option. The time for action has come. The cry is at our doors; it will not wait long for an answer. The social forces are aroused and ready for dispute—yes, even violence. Shall they go on blindly or wisely? Shall they attain their desires by such revolutions as have hitherto been their outlet, or shall they be led into a fuller light by scientific rational moral progression? This is one of the most trenchant arguments for an immediate, thorough, and extensive school of sociology. It is a plea that every one can understand, and to which there should be the most generous response. Such an institution will aim at the broadest curriculum; it will differentiate the chairs; it will give opportunity for research and publication; it will combine character with culture; it will seek the reformation of society by the reformation of men. In the present obscurities of the science, it will not aim to represent one tendency, but all. It is with no little pleasure that I mention the cordial and stimulating reception, which the scheme projected by the Education Extension society, of Hartford, has met in its effort to lay the foundation of such a school, whose first year begins on October fifth. It is obvious that there is no little difficulty in compelling the popular and pedagogic acceptance of sociology as a profession. It is out of the beaten track. It is not a member of the bread and butter group. It has a place to make for itself, but it will make it; indeed, the multitude of laborers already afield without any discipline, other than that of religion, morality, and experience, has broken the ground. Every other study has undergone the same treatment. Many of these still clamor at university doors, but are refused hospitality. A genuine university order would embrace instantaneously every possible realm of knowledge, and transmute them into science and art. Sociology will not lack a welcome in due time.

CHESTER D. HARTRANFT.