possible, as the smaller one had been to school only one year, and that in a little log cabin up in the hills. But when I called her attention to the fact that these boys had lived on a farm where they had been taught to assume responsibility and to do things, she agreed with my explanation.

I believe that it is the pedagogical value of farm work and the chance of placing responsibility on the child that has more than anything else to do with the development of efficiency and character in farm children, and this accounts for the fact that 29 per cent. of our population on the farms furnishes 70 per cent. of the efficient men in this country.

We have much yet to do before we understand the whole of this question. I believe, however, it is possible to outline a course which shall deal directly with the industries of our people and which will not only better fit pupils for their life's work, but will even fit them for college better than the best of our present high schools. We all recognize that because of our ignorance of the real principles involved in training the young mind, a lot of experimenting must be done before we have arrived at a final solution of this important question. The criticism I have to make of our school system is that we have neglected these essential experiments. It is high time that earnest effort be made in this direction.

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The Simple vs. the Complex in Scientific Theories

There seems to be a growing feeling that our present hypotheses concerning the structure of matter, and its relation to electricity, are becoming unsatisfactory. The reason for this is the increasing complexity of the phenomena, as we see them, and of the corresponding explanations which this involves. This feeling does not seem to be well founded. A former cave dweller, who has been for a few thousand years an inhabitant of some of the regions which Dante has described, would find our modern life an array of very complex phenomena.

He would observe that empty apartment houses attract homeless families. He would learn that this could not be accounted for by Newton's law of gravitation, although gravitational attraction between houses and people certainly does exist. He might feel inclined to give up Newton's law, because it does not explain all attractions. He finally learns that ether waves are involved in this phenomenon. The people must see the house before it can have any attraction for them. He would learn that the architecture of the house really appeals to the minds of these people. Being something of a philosopher, he constructs a mental field of force, which lays hold of the building and its surroundings, and which proceeds from the conscious beings. He is greatly interested in seeing that people appear very much alike, while houses differ very greatly in construction, in material and in mass.

As he has not yet learned anything about electrical and kindred phenomena, our visitor may be excused if he refers to the people as negative electrons or ions, and to empty houses as positive ions. When a house contains families enough, so that it ceases to have any attractions for more, he calls the combination an atom. He observes that more people can be forced into a house already normally filled, but the motive forces must come from some external source.

He finally learns that a family which has been more or less forcibly ionized, and is about to enter a new home, must deliver to its former occupant and owner, the value-equivalent of a certain number of foot-pounds of mechanical work previously done. The value-equivalent of this mechanical work may exist in the form of a certain number of grams of some valuable substance which is actually delivered. The value to be transferred may also exist potentially in the form of credit at a bank. The transfer of this value may then be effected by entries in the books of the bank, which transfer credits from one customer to another.

By the time our visitor has learned all these well-known things, it would appear that he

should not be greatly alarmed at present developments concerning electrical phenomena.

We know that molecules on the sun are in constant wireless communication with molecules on the earth. We can partially interrupt this communication by interposing a screen having a diameter of a centimeter or two. The molecules within the shadow now receive impulses transmitted to them by those outside of the shadow.

Here we have an action which is sufficiently amazing. Any explanation which we might make of it could not involve anything more wonderful than the action itself.

After we admit the existence of matter and of electrical phenomena, as we now know them, why may we not assent to the proposition that all atoms of matter are composed of positive and negative electricity or of positive and negative ions? This is essentially Franklin's hypothesis, deprived of its occult features, by reason of what has since been learned. The conductors in a power service are then aggregations of positive ions, or of positive electricity. The negative ions, or, as Franklin would have stated it, the electrical fluid, flows through what we now call the positive ions. Their rhythmical transfer from atom to atom accounts for the Joule effect. In addition we may have conditions which involve an actual and sudden transfer of kinetic energy from the moving negative ions to the positive ions. Such a case we have in the electric arc, which seems to me to be mainly a Thomson effect.

It is now established that the positive and negative discharges, which Wheatstone examined with the revolving mirror, are in the nature of compression and rarefaction waves. They are waves in Franklin's fluid. The negative terminal of any battery or dynamo is the compression terminal. From this terminal Franklin's fluid flows.

The writer has obtained photographs of the Wheatstone sparks and Wheatstone's conclusions concerning direction of propagation of the discharges from the terminals have been fully verified.

FRANCIS E. NIPHER

SCIENTIFIC BOOKS

Research in China. In three Volumes and Atlas. Vol. I., Part I. *Descriptive—Topography and Geology.* By BAILEY WILLIS, ELIOT BLACKWELDER and R. H. SARGENT. 4to, pp. xiv + 353 + index. Pls. LI.; figs. 65. 1907. Vol. II. *Systematic Geology.* By BAILEY WILLIS. 4to, pp. v + 133 + index. Pls. VIII. July, 1907. Published by the Carnegie Institution of Washington.

These admirably written and illustrated volumes should be read by all scientists interested in the geology of Asia and also by those interested in the larger problems of diastrophism and geologic history. The first and larger volume will be used more especially as a work of reference for details of Chinese geology; the second volume treats the same material in a condensed and systematic manner, following the course of geologic history and covering to some extent the whole of eastern Asia. Applying throughout the recently developed principles of diastrophism and physiography, a field of research in which the senior author has previously done distinguished work, these volumes mark a distinct advance over the previous comprehensive treatises dealing with this region, von Richthofen's "China" and Suess's "The Face of the Earth." The atlas, by the incorporation of Chinese characters, has been made readily available to the Chinese, and in the modern educative awakening of China such a publication dealing with that portion of the world may be of material aid in stimulating an interest in the earth sciences. It must not be thought, however, with national self complacency that the general educative effect need be restricted to China. The photographs and descriptions of certain districts bring home the desolation which may result from reckless deforestation, with the consequent sweeping of soils from the hillsides and burial of valley alluvium beneath sand and gravel. This is a lesson the American people still need to learn and the material has already been utilized by the *Outlook* and the *National Geographic Magazine.*

The route of the expedition lay first into the Shantung peninsula, thence from Peking southwestward through north central China