and other objects not diatomaceous, and even a calcareous foraminifer. Nothwithstanding these little discrepancies, the fertilizer received gratuitous indorsement from several of the leading scientific journals of England and America. In one of the latter a college professor gave it a splendid "send-off" in an article of very learned appearance, entitled 'Silica of Grasses and other Plants carried up as Diatoms or other Siliceous Grains, and not in Solution or as Soluble Silicates,' which was accompanied by the paradoxical plate above referred to.

In the cases I have mentioned, both the wholly uninformed masses and the broadly educated few were confidently calculated upon as easy victims to fraud when the recognition of some of the commonest of microscopic forms was involved. Diatoms exist on every hand, and, in both the living and the fossil state, are among the most plentiful of organisms; their indestructible remains constituting strata from three to thirty feet thick, extending through several of our seaboard States, while any Croton-water faucet will, in a moment or two, furnish abundance of living specimens of wonderful interest and attractiveness. Besides this, they have a considerable commercial importance, at least one New York firm making a trade specialty of the diatomaceous earths and the silicates made from them. And yet only a few weeks ago one of our daily journals devoted valuable space to sarcastic editorial comment on the examination papers used in the College of the City of New York, because they contained the supposed impractical and nonsensical question, "What is a diatom?" It now seems that it would be money in the pockets of some poor invalids if they only knew the difference between a diatom and a microbe.

It is the greatest shame of these impositions under the guise of science that professional men of some reputation at times lend them their countenance and aid. And, even when the thing recommended is not itself fraudulent, the mode of indorsing it often becomes so. An example of this came under my notice not long ago, when, in looking over a newspaper, my eye was caught by the word 'microscopical' occurring in a rather prominent advertisement of a certain soap, and upon examination I found that a gentleman of scientific claims had undertaken to give a certificate to the merits of the article advertised. Now, soap seems to be a thing about which comparatively little can be said from a sanitary point of view, except that a free use of it is desirable. But in the testimonial of which I am speaking there was manifested a wide-awake disposition to make the most of the passing public interest in infection and contagion. With remarkably lame logic, the scientific attorney of the manufacturer declared, in substance, that, having submitted the soap to microscopical examination, and having found it free from disease-germs, he was prepared to recommend it for its detergent qualities.

While we do not wonder to see a Wiggins rush forward, upon the very slightest excuse, as he did but lately, with a sixteenth-century astrological theory of yellow-fever, we cannot but feel both astonishment and mortification when a good chemist publicly dispenses bad microscopy, or an eminent physicist plunges headlong nto hygiene and therapeutics, as one did the other day. A man may have almost superhuman insight as to the laws of electricity and yet be as ignorant as the rest of us about the how and why of a bacillus or a spirillum. It was not very strange that a gentleman hitherto absorbed in physics and mechanics should prove to be uninformed as to the unsuccessful endeavors that had been made to isolate and identify the microbe of yellow-fever, for he had come across-lots into a scientific region of which the literature and even the language was unfamiliar to him. For the same reason, how was he to know that what would kill an ant would not necessarily kill a bacterium or a vibrio?

The trouble is, that a large part of the people who are most ready to discuss the new phase of biological science have not the faintest idea of what a microbe is. Most of them seem to fancy that merely a new name has been invented for what used to be called a spore or a germ; and of course every one knows what a germ is, for he has only to look at the seed of any well-known plant! This seems to be the difficulty with a famous military commander who has recently taken up the weapon more powerful than the sword, and, by means of it, given to the world, through one of our magazines, his *a priori* exposition of the mode of origin and spread of epidemic diseases. He may fairly claim experience in keeping yellow-fever out of a community, but, after reading his article, we may well doubt whether he really has much information as to how it gets in.

In short, pseudo-scientific humbuggery is very prevalent just now; but I suppose we may console ourselves by regarding it as a popular tribute to the worth of true science, since we are told that "hypocrisy is a sort of homage that vice pays to virtue."

CHARLES F. COX.

New York, Nov. 20.

New York Archæology.

THE Bureau of Ethnology has been doing some work in western and central New York, the results of which will soon appear; but researches quite as important and exhaustive have long been going on without public aid. If the State, or individuals in it, would take the lively interest in preserving accounts of its perishing antiquities that is shown in other things, valuable results would be certain to follow. In carrying on my own investigations, I have been surprised to see how many are working in various places on similar lines, and in the way of comparison these quiet seekers have helped me much.

The leading feature in all this is the connection of relics with sites. All use maps; and on these all local sites are indicated, and a record is made of their extent and character. All articles are numbered or labelled with reference to these sites, so that the cabinet generally shows whence the relic came. This is not always possible, but in most cases it can be done. A good antiquarian who has thrown unexpected light on one group of sites has but one arm, and yet makes drawings of the more interesting forms. I draw and describe all in my own collection, and obtain figures of large numbers of those in others. Without such a comparison, I could not have arrived at some sound conclusions.

In all these cases precision has been aimed at, and the general agreement is the more surprising when we find there has been no consultation in the matter. A large county map or atlas is used for the sites, when it can be had; and this allows of an exact record of the town, lot, farm, and even part of a farm, when desired. In making records, however, the Smithsonian code of signs is almost useless in New York, and is very little employed. The historical societies aid a good deal in the preservation of relics, but there is less aid to the scientist from their collections than might be expected. A few articles are labelled in a general way, sometimes very oddly; but care is seldom taken to connect them with the sites from which they came. Their value would often be tenfold greater were this done. It should therefore be urged upon all societies and individuals to make records of sites and relics in this way.

For scientific purposes there is frequently a deficiency in the collection of the ruder articles, as flat sinkers, chipped celts, grooved and hammer stones, but in a number of instances care has been taken of these also. Some of these are still in use in New York. It is well known, however, that some common articles in other parts of the land are very uncommon here. This is the case with the grooved axes; and the absence of early small wampum west of the Hudson River is so noticeable, that I quite agree with early writers in their statement that it was little used until the Dutch made it.

A collection of sites and relics has thrown much light on the early Indian migrations in northern and western New York, bringing out curious facts in regard to the routes chosen and the origin of the travellers or residents. It has dispelled much of the vagueness attending the occupation of the Iroquois territory, and enabled us definitely to connect historic with prehistoric times. That the facts brought out by field-workers have not always agreed with the theories of students is not surprising, but theories must always be regarded as but a temporary convenience.

In connection with this, I may call attention to a branch of ethnology which needs speedy attention, and has already received some. New York embraces within its limits a portion of the noted Six Nations, who still preserve some of their old customs, ornaments, and implements; but all who frequently visit their reservations are aware how rapidly the old is giving place to the new. To gather up the fragments is all that we can now do. Whoever un-

dertakes this work must remember, that, while all had much in common, these nations had an independent character, and that their laws, clans, feasts, traditions, and language varied greatly. Morgan's valuable 'League of the Iroquois' was a good account of the modern Senecas. Any one would be misled in applying it strictly to the Onondagas. Each nation, therefore, is worthy of independent study. If some competent person, conveniently near, would undertake this for each reservation, the results would be of great value.

W. M. BEAUCHAMP.

Baldwinsville, N.Y., Nov. 12.

Species and Subspecies: A Reply to Mr. Conn.

IN *Science* of May 25, 1888 (pp. 253, 254), Mr. H. W. Conn reiterates a belief, held in common by Romanes and himself, that there is a fundamental difference between what he calls 'varieties' and 'species.' The term 'variety' is objectionable on the ground that it is susceptible of several meanings, and consequently may be understood differently by different persons. It may be assumed that the word is used by Mr. Conn in the sense in which naturalists employ the term 'subspecies,' or 'geographical race.'

Mr. Conn says, "There is no question in biology more significant, or more difficult to answer, than what constitutes a species. Upon the answer hinges the question of evolution, and more particularly the theories of Darwin. In spite of an immense amount of discussion, no answer has ever been given to the question which is in any degree satisfactory."

The above statement demonstrates the ignorance of its author in matters well understood by those who handle species, and may be taken as an illustration of the results of the methods of teaching biology now employed in our leading schools, where systematic biology is entirely lost sight of in the effort to impress upon the student the superior importance of morphology, histology, and embryology: in other words, the student is encouraged to turn his back to the broad field of nature, and to open his eyes only to peer into the contracted field of the microscope.

Systematic naturalists — those who have to do with the interrelations of existing forms of life — do not experience the difficulty mentioned by Mr. Conn in defining "what constitutes a species," and are forced to protest against his statement that "no answer has ever been given to the question which is in any degree satisfactory."

A species is a group of individuals which resemble one another in all essential respects, varying only within certain definable limits, and which is separated from all similar groups by a well-marked hiatus. A subspecies or geographical race differs from a species in one respect only; namely, that intergrades exist connecting it with the parent stock: in other words, a subspecies is nothing more nor less than an incipient species.

Mr. Conn holds that 'varieties' are the result of variations in structure outside of the reproductive organs, while 'species' result from changes in the reproductive organs themselves. He says, "Variety and species are therefore independent, being founded on different kinds of variation." This hypothesis, it seems to me, is in its very inception a contradiction of the genius of evolution.

All forms of life inherit two tendencies, — one to reproduce exactly the characteristics of their ancestors, the other to vary therefrom. Variation is the result of one or the other of two sets of causes: namely, (1) the influence of climatic or other physiographic conditions; (2) the accidental or sporadic acquirement of a character which benefits its possessor, and hence is likely to be perpetuated, and increased from generation to generation. In order to clearly understand the laws of evolution, it is necessary to discriminate between these two kinds of variation. In variation resulting from the spontaneous acquirement of a beneficial character, the line of evolution is geographically stationary, but is ascending in time. Natural selection is the cause of this form of evolution; for the excess of individuals resulting from normal reproduction brings about a struggle for existence, and the law of "the survival of the fittest" results in the extermination of the parent form and the successive intermediate stages, so that the modified form and its ancestors are not in existence at any one period of time: in other words, the line of descent must be looked for in the history of the past, among strata containing paleontologic remains. On the other hand, evolution due to geographic position — environmental evolution — may present all intermediate stages at the same time; the extremes, which we call subspecies, being found at distances remote from the centre of distribution of the type. Hence in the study of evolution it must be constantly borne in mind that there is this essential difference between 'geographic variation' and 'variation by natural selection:' that in the one case intergrades exist, in the other case they have become extinct during the process of differentiation.

Variation often takes place in more than one direction, producing several lines of differentiation which radiate from a common centre. In such cases there will be several peripheral forms which may differ from one another more markedly than each differs from the parent or central type.

In environmental variation the intermediate forms which connect the extremes with the central type, or with one another, are termed 'intergrades,' the peripheral forms being recognized as subspecies. The term 'peripheral' is here used in a geographical sense, implying that the individuals showing the peculiarity are found at points remote from the centre of distribution of the type.

It often happens that subspecies differ from one another and from the parent stock as greatly as species themselves. It sometimes happens, also, that in the course of time the forms inhabiting the intermediate region cease to exist, in which case the peripheral forms previously known as subspecies become species at once, without waiting for any further change; the only difference between species and subspecies being, as already stated, that in one case the intergrades exist, in the other they have become extinct.

C. HART MERRIAM.

Washington, D.C., Dec. 1.

Rosenbusch's Petrography.

YOUR reviewer, in his recent notice in your columns of Mr. Iddings's admirable translation and abridgment of the first volume of Rosenbusch's 'Mikroskopische Physiographie,' seems to me to have hardly apprehended the exact aim of this work. Inasmuch as the review, while not altogether unfair in its statements, may by its general tone convey the impression to those unacquainted with petrography that they are losing in the translation many essential features of the original manual, I beg leave to give the results of my own experience in the practical use of both books for purposes of instruction in a petrographical laboratory.

Heretofore the only available manual for the use of beginners in petrography has been Rosenbusch in the original; and every teacher, even in Germany, must have felt that for this purpose the book is somewhat cumbersome. My own experience has been that the mass of detail, however advantageous and necessary to the advanced worker, caused a loss of interest to students who were beginning the subject, even when they belonged to a superior class and possessed a tolerable knowledge of German. Those who, from an intimate acquaintance with Professor Rosenbusch's treatise, realized its great value, were loath to recommend even to beginners any other guide; and yet the need has long been felt of a translation which should present all the essential features of the work in English, without the mass of detail unnecessary for those taking their first steps in petrography. This need the translator has set before himself to fill, and in my opinion he has accomplished the task in a most judicious and satisfactory manner. Since the appearance of his translation a few weeks since, I have used it in my laboratory with a success which I had begun to despair of ever attaining with the original. Nothing really essential has been omitted, while the book has been reduced to nearly half its former size. The colored plate could be of no practical use to beginners, but would have increased the price of the work very considerably.

In his own preface the translator states that he has had no expectation or desire to supplant the use of the original. No student would dare to venture upon original investigation in petrography without a knowledge of German sufficient to enable him to read with ease the work in its extended form. To advanced workers Rosenbusch will be now, as ever, a vast treasure-house of information, which no abridgment of the translation will in any way curtail.

GEORGE H. WILLIAMS.

Baltimore, Nov. 30.