

Professor Smith's work is certainly a good book for good students, and as such is to be heartily welcomed.
H. L. WELLS.

SCIENTIFIC JOURNALS AND ARTICLES.

The Botanical Gazette for August contains the following papers: 'The Nascent Forest of the Miscou Beach Plain,' by W. F. Ganong, being the fourth contribution to the ecological plant geography of the province of New Brunswick; 'The Development and Anatomy of *Sarracenia*,' by Forrest Shreve; 'Physiologically Balanced Solutions for Plants,' by W. J. V. Osterhout; 'The Appressoria of the Anthracnoses,' by Heinrich Hasselbring; '*Nereocystis Luetkeana*,' by Theodore C. Frye, being a biological study of this giant kelp; 'New Species of *Castilleja* and *Senecio*,' by J. M. Greenman. The September number contains the following papers: 'Differentiation of Sex in *Thallus* Gametophytes and Sporophytes,' by A. F. Blakeslee, being a general discussion of sexuality in all the plant groups; 'The Development of the *Bouteloua* Formation,' by H. L. Shantz, being the second contribution from his study of the mesa region east of Pike's Peak; '*Cortinarius* a Mycorrhiza-producing Fungus,' by C. H. Kaufmann, in which a new species of the genus is described that is connected with three forest symbionts belonging to different families; 'A New Fungus of Economic Importance,' by R. E. Smith and Elizabeth H. Smith, being a new genus (*Pythiacystis*) parasitic on lemons and causing a decay of green fruit trees and in the storehouse.

DISCUSSION AND CORRESPONDENCE.

DISCONTINUOUS VARIATION AND PEDIGREE CULTURE.

REFERRING to the recent address of Dr. D. T. MacDougal, on 'Discontinuous Variation and Pedigree Culture' (published in *The Popular Science Monthly* for September), the following points may be worth considering:

The species is the unit of the taxonomist, and the study of species and their relations to environment form the basis of the science of distribution.

The species, as thus considered, is a kind of animal or plant as it has developed and as it appears in a state of nature. To know a species as it appears is not to know it completely, as all species develop differently under changed conditions or freed from the stress of competition. Under domestication, or under new chemical or physical conditions, all species are plastic, and all may assume forms the same species can never assume in its original habitat.

The field naturalist can not therefore know everything about any species, no matter how many individuals he may examine. Neither can a garden naturalist, for the forms he deals with must be 'reduced to the ranks' before they are comparable to the species occurring in the wild.

It is presumable that those naturalists know most about species as they are, who have given most time and thought to their study. They may not, however, know better than any others how species originate, nor possess the clue to the main causes or significance of their varying forms.

Yet it is fair to say that as the taxonomist of species finds in practically every case a geographical element in the development; as he finds that segregation and selection have apparently been accompaniments of nearly all changes in species, and as by these same agencies all species can be appreciably changed by the will of man, he may not unreasonably suppose that segregation and selection have each taken some part in that life-adaptation which we call organic evolution.

As a zoologist personally acquainted with Dr. de Vries the writer has great reverence for the noble modesty, the patient, intelligent and epoch-making perseverance which have characterized his work. On the other hand, he is obliged to hesitate at the acceptance of the more sweeping parts of his theory, and to question the assumption that the discoveries of de Vries in plant mutation disclose the actual method of species-forming, general or universal, in all branches of life.

As matters are the species that exist in nature must furnish us our conception of species. The species actually covering the earth are

surely 'real' species, whether other forms called species are 'real' or not. We find no evidence that such species could not or do not originate, sometimes at least, through slight fluctuations acted upon by selection in segregation. We do not know that the effects of selection have any final limit except in certain cases where the limit is mechanical. It is not yet clearly shown that there is any real and fundamental difference between continuous and discontinuous variation, and most zoologists regard the conception and cycles of variation in the history of a species as an ingenious suggestion rather than as a part of science.

It is evident that there is much—very much—about animals and plants, which can be learned only from experimentation under changed conditions, as there is much that can not be known or even imagined without the aid of the microscope, and much that can not be known or imagined without the comparative study of many individuals and the comparison of faunal and floral areas. We must welcome the study of pedigreed individuals, animals or plants, as a most hopeful line of investigation, and it is certain that the discoveries it may yield can not be forestalled in advance. If they could the investigation would be unnecessary. So far as species are concerned, it is clear that a large part of the problem demands the study of the structure of forms and their relation to environment. There is much truth in Darwin's words that "One has hardly a right to examine the question of species who has not minutely described many."

As to the suggestion of the possible hybrid origin of *Oenothera*, the writer is not a botanist, and very much of botanical investigation escapes his notice. He is pleased to learn that the possibility of such origin on the part of *Oenothera lamarckiana* has been considered and fully disproved. A detailed account of the experiments which show this would be interesting. It would also be interesting to know the degree in which Burbank's hybrid walnuts of the second generation, showing 'every conceivable kind of variation,' conform to the Mendelian theory.

As to the theory that species are permanently changed by the direct impact of environment, which most faunal zoologists in America seem to accept, the writer thinks that Dr. MacDougal is probably right in claiming that "no evidence has yet been obtained to prove that the influence of tillage, cultivation or the mere pressure of environmental factors has produced any permanent changes in hereditary characters of unified strains of plants," or of animals either.

DAVID STARR JORDAN.

VULCANISM.

I HAVE read the article of Elihu Thomson,¹ much of which is necessarily true, with considerable interest; but I doubt whether I can go so far as he does, partly because I have a pet theory of my own to nurture. What I miss in Thomson's article is some definite estimate or clear-cut specification of the actual conditions involved: how much stuff is moved; what work is spent; how much heat is generated. I have endeavored to picture the occurrences to myself in a cursory way for a normal case, somewhat as follows: The work done per cubic centimeter will in any distortion be half the product of the stress and the strain. This work will be elastically potentialized if the solid remains intact. If there is rupture it will appear as heat largely near the surface of separation. If it yields viscously (as is much the more probable) it will appear throughout the volume. The strain is probably a shear. The question at issue is then under what circumstances of torment must one shear a rock in order to melt it. Suppose we say the shear is one half, *i. e.*, if the tangential thrust is horizontal all initially vertical lines will be inclined thirty degrees; or in general there will be corresponding changes of inclination of thirty degrees, which seems to me to be enormous, but may, nevertheless, be admitted for the purpose of argument. We may then write, if the density of rock is 3, its specific heat .2, its igneous melting point as low as 1,000° C.,

$$\frac{1}{2} \times \frac{1}{2} \times F = 3 \times .2 \times 1000 \times 42 \times 10^6,$$

¹ SCIENCE, XXIV., p. 161, 1906.