

give his course of lectures on philosophy under the auspices of the Graduate School, and it is expected that he will continue to give at least one course to the undergraduates.

DR. HENRY LOUIS SMITH, president of Davidson College, has been elected president of Washington and Lee University.

MR. H. R. FULTON, associate professor of botany in the Pennsylvania State College, has been elected to the professorship of botany and vegetable pathology in North Carolina College of Agriculture and Mechanical Arts.

BEVERLY W. KUNKLE, now instructor in the Yale Sheffield Scientific School, has been appointed to the chair of zoology at Beloit College to assume his duties in September.

IN Macdonald College, Ste. Anne de Bellevue, Quebec, the following have been appointed to fill the positions named: *Lecturer in Biology*: W. P. Fraser, M.A., Pictou, N. S. *Lecturer in Poultry and Poultry Management*: M. A. Jull, B.S.A., at present Live Stock Commissioner of the Province of British Columbia. *Assistant in Animal Husbandry*: W. J. Reid, B.S.A. *Assistant in Biology*: Peter I. Bryce.

DISCUSSION AND CORRESPONDENCE

"PHENOTYPE" AND "CLONE"

IN calling attention to the frequent misuse of the words "genotype" and "pure line," Jennings says¹ that the word "phenotype" "designates a group of organisms which in outward appearance seem to belong to one type, although in hereditary constitution they may actually differ greatly. *Genotype*, in Johannsen's usage, is not directly contrasted with phenotype," etc.

As I have also used "phenotype" with the meaning indicated by Jennings, I did not recognize the fundamental misconception involved in the quotation given above, when I wrote my note² in response to the article from which this quotation is taken. My attention has been called to this point by Dr. Johannsen, and it seems best to set the matter straight at once, in connection with the at-

tempt made by Jennings and seconded by myself, to restrict to their original meanings, the other terms introduced by Johannsen. "Phenotype" and "genotype," when both are rightly used, are *contrasted terms*, both being *abstractions* referring to the *type* to which an individual or group of individuals belongs, and *not to the group of individuals* belonging to that type. To illustrate the use of "phenotype" in its correct sense, reference may be made to the F_2 of a Mendelian hybrid. When an F_1 hybrid whose genotypic constitution may be represented by the formula, $XXAaBb$, is self-fertilized or crossed with another individual having the same formula, there will be possessed by different individuals among the offspring nine different genotypes, but only four different phenotypes. The nine genotypes may be represented by the formulæ: $XXAABB$, $XXAABb$, $XXAaBB$, $XXAAbb$, $XXaaBB$, $XXAaBb$, $XXaabb$, $XXaaBb$ and $XXaabb$. The four phenotypes may in similar manner be indicated by the formulæ: XAB , XAb , XaB and Xab . As the "phenotype" is the "type of the phenomenon"—the type of that which actually appears—there must always be as many distinguishable groups of individuals as there are phenotypes; hence, the readiness with which the word "phenotype" has been misinterpreted and applied to the group of apparently equal individuals instead of the constitution or assemblage of characteristics with respect to which such a group of individuals is apparently homogeneous.

There is at present no satisfactory word universally applicable to all groups of individuals possessing the same phenotype—the concept for which the word "phenotype" itself has been misused. The words "species" and "sub-species" used by taxonomists are applicable, at least in some cases, to groups of such phenotypically equal individuals, but no one would think at present of applying either of these words to all the numerous slightly differentiated groups which the geneticist is now able to distinguish and with which he is obliged to work. A short and appropriate word for all such groups of individuals,

¹ SCIENCE, December 15, 1911.

² SCIENCE, January 5, 1912.

of whatever degree of differentiation, is greatly needed.

In my discussion of "clone" as a suitable name for any group of plants or animals which has been formed from a single original individual by purely vegetative methods of reproduction, I suggested the restriction of the term to groups of genotypically identical individuals. Further consideration convinces me that this restriction is highly undesirable because it is impracticable. It would be quite impossible to know for a certainty that two twigs used as cuttings or cions from the same tree had the same genotypic constitution, and consequently there could be no security in the assumption that they were members of the same clone, if the definition given in my previous note should be maintained. I wish, therefore, to offer an amendment to that definition by striking out such restriction. The definition may then read: "Clone, a group of individuals traceable through asexual reproductions (including parthenogenesis when unaccompanied by genotypic segregation) to a single ancestral zygote, or else perpetually asexual." This definition puts the word "clone" on exactly the same footing as the expression "pure line," making it a purely genealogical term and involving no implication whatever as to the genotypic equality of the individuals included in the single clone.

GEO. H. SHULL

THE PRIBILOF FUR SEAL HERD

TO THE EDITOR OF SCIENCE: In SCIENCE of October 27, 1911, page 568, there appears an article entitled, "The Pribilof Fur Seal Herd, and the Prospects for its Increase," signed by C. H. Townsend, member of the Advisory Board of the Fur Seal Service.

Dr. Townsend in his article handles rather severely certain persons "whose opinions upon the subject are of little value." I cheerfully admit that I am one of the persons referred to, and I shall be equally frank to say that I am sorry Dr. Townsend feels the way he does, for at the bottom we both desire the same thing, namely, the rehabilitation and preservation of the fur seal herd.

A scientist who desires his opinions upon any subject to be of value must, above all, be accurate as to his facts. In his article Dr. Townsend tells us that "The hook-worm is one of the contributing causes to heavy annual losses among the young seals born on sandy areas."

In view of this statement, I would like to call Dr. Townsend's attention to the report of Walter I. Lembkey, agent in charge of the Alaskan Seal Fisheries, dated December 14, 1906 (page 274), printed as Appendix A to Hearings on House Resolutions No. 73:

Inquiries have been made recently of the Department concerning the present effect of *Uncinaria* on the seal pups, and it has been strongly intimated by certain persons that thousands of pups die annually from the ravages of this parasite, of which no report is made in the agent's report. The fact is that *Uncinaria* has not now, nor has had for several years past, any known existence on the islands. This statement is justified by actual and careful examinations during the last three years.

Also to the report of Harold Heath's "Special Investigation of the Alaska Fur Seal Rookeries, 1910" (same publication as cited above, page 1223):

In earlier times the ravages of the parasitic worm *Uncinaria* were especially noticeable on the Tolstoi sand flat and portions of Zapadni; but in recent years, due to shrinkage of the herd, these areas have been abandoned. Very few cases were noted by Dr. Chichester in 1909, and not one was detected this year. The dead pups dissected were seemingly in a perfectly normal condition, their emaciated appearance and empty alimentary canal indicating death from starvation.

On the question of the closed season Dr. Townsend is especially severe. He tells us that a cessation of slaughtering seals would be "positively dangerous," because of the rapid increase in fighting males. I once made the suggestion to him, favorably received at the time, that as the old bulls haul out on the breeding grounds some ten days in advance of the females, it would be rather a simple matter for the agent in charge and his Indians, armed with a few modern rifles, to dispose of these dangerous surplus bulls. But a far