while submarine eruptions took place in the neighborhood of Pantelleria in 1831 and 1891. The small and hitherto undescribed island of Linosa, about one square mile in area, contains nine volcanic cones. These are referred to two periods; an earlier one of cones of greenish and yellow tuffs, containing blocks of basalt, and a later one of cinder cones, with lava flows of feldspar-basalt and nephelite-basalt. The Linosa lavas are very uniform in chemical characters.

Many analyses of the rocks have been made, and they are shown to be closely alike in their chemical features, one of the most notable of these being the uniformly high percentage of titanium. All the volcanoes mentioned are considered, therefore, to be genetically related and to belong to the same co-magmatic region or petrographic province, which possibly extends into Africa, as far as the Great Rift Valley. This petrographic province is very different in its characters from those of the Italian peninsula and also from that embracing the volcanoes of the Grecian Archipelago and Asia Minor, which have also been studied by the speaker. The reputed volcano of Boukournine, near Tunis, was visited and was found to be composed entirely of limestone. A brief account was given of the occurrence of orbicular diorite at Santa Lucia di Tallano in Corsica. The paper was illustrated by lantern-slides.

RALPH ARNOLD,
Secretary

DISCUSSION AND CORRESPONDENCE

THE DISTRIBUTION OF CLOSELY ALLIED SPECIES

THE idea that closely related species do not possess identical geographical distributions is a theoretical deduction which should be rigorously tested by the examination of actual cases. Recently, R. G. Leavitt has done this with reference to plants (chiefly orchids),[1] and arrives at the conclusion that this principle, as expressed by D. S. Jordan,[2] is not well supported.

[1] "The Geographical Distribution of Nearly Related Species," *American Naturalist*, 41, 1907, pp. 207–240.

[2] "Given any species in any region, the nearest related species is not likely to be found in the same region" (SCIENCE, 22, 1905, p. 547).

[3] *Proceedings American Philosophical Society*, 44, 1905, pp. 127, 128.

[4] *American Naturalist*, 41, 1907, p. 654.

[5] "The Crawfishes of the State of Pennsylvania," *Memoirs Carnegie Museum*, 2, 1906, p. 512.

[6] See also SCIENCE, 23, 1906, p. 949.

Nevertheless, I think that Jordan's sentence is fundamentally correct, provided it is changed so as to refer not only to purely geographical, but also to ecological conditions.

I have expressed this idea in two sentences:[3] (1) "Closely allied species occupy neighboring areas"; (2) "More or less closely allied species occupying the same or nearly the same territory, generally possess different habits." Further, I have treated of this subject more especially in a recent publication,[4] classifying the forms of segregation of closely allied species, geographically as well as ecologically.

It will be remarked that, wherever I have talked about this subject, I always have used the word *species*.[5] Leavitt, in the paper referred to (p. 230), deliberately changes the word *species* in Jordan's sentence into *kind*, and investigates the distribution of "pairs of kinds" of plants. This substitution, *kind* or *form* in place of *species*, is also advocated by J. A. Allen.[6]

This change, however, is entirely inadmissible. I used the above phrases in connection with the bearing of isolation or segregation upon the formation of species (speciation), and wanted to bring out the idea that geographical or ecological segregation is a criterion by which *species* may be recognized. I intended the word "species" in the strict taxonomic sense, that is to say, for "forms" which are morphologically separated from the allied forms. My object was to express the opinion that the morphological segregation of true species is connected with and due to some kind of segregation in the physical conditions under which the "species" live, and I pointed out that this might be either purely geographical or ecological. *Ecological or geographical segregation is the factor which results in speciation,* that is to say, the factor which

makes species out of variations or varieties ("forms" or "kinds").

Consequently, when Leavitt demonstrates that there are many "pairs of kinds" of plants, which possess the same range, he does not prove that the sentence referred to is incorrect, but he may have shown only that the "kinds" he discusses *are not species.*

This is clearly seen in the instance of *Cypripedium pubescens* and *parviflorum* (p. 235). Even granted that the ranges of these two forms practically coincide (p. 236), we may conclude as well that they are not species. This indeed is supported by other observations. O. W. Knight has shown[7] that these two "forms" are merely variations, which may be observed successively in one and the same plant, according to the character of the environment: *C. parviflorum* has been transformed into *C. pubescens* by the change of the environment, and *vice versa.*

In other cases, quoted by Leavitt, we may have to deal with species: but the facts given are too scanty to form an opinion. I have repeatedly emphasized that only an exact and *complete* knowledge of the distribution is apt to give us the means of judging as to segregation and speciation of the forms in question. Leavitt's instances are very defective in this point, and I shall take up one of them, in order to make clear what I mean.

The range of *Spiranthes cernua* (=*Ibidium cernuum*) is given (p. 234 f.) as: Massachusetts, Ontario, Iowa, Georgia;[8] and that of *Spiranthes odorata* as: Georgia, Florida, Alabama, Louisiana, Texas.[9] Thus, as Leavitt says, the range of the latter "coincides widely with that of *S. cernua.*" However, we do not know whether the two "forms" are ever found associated, *i. e.,* under the same environment, in those parts of their range which overlap in the southern states. Besides, it is evident that the one is more northern, the other more southern in its distribution, and possibly their centers of origin and radiation were segregated accordingly. And finally, the morphological facts are different from what they appear in Leavitt's statement.

According to this (and to the quotations from Britton and Brown), we should expect *Ibidium cernuum* in western Pennsylvania. But this species seems to be absent here, and it is represented by another one, described recently by O. E. Jennings:[10] *Ibidium incurvum.* This was first discovered in Erie County, Pa. But additional localities in Beaver, Allegheny, Westmoreland and Armstrong Counties, Pa., are represented in the herbarium of the Carnegie Museum (the specimens were partly labeled *cernuum,* partly *odoratum*), and the new species has been found in large numbers very recently (September and October, 1907) in Allegheny county by Jennings, and in Beaver county by the present writer. *Ibidium cernuum* is absent in this part of Pennsylvania: at any rate, all plants called by this name seem to be *incurvum.* Thus, with reference to *Ibidium cernuum* and *incurvum,* the rule holds good, that two closely allied species are not found associated under the same conditions, and this rule also fits beautifully the case of *Ibidium incurvum* and *odoratum,* which are even more closely allied. It remains to be seen what the distribution of *I. incurvum* will turn out to be outside of western Pennsylvania. Possibly, many plants called *cernuum* or *odoratum* may be the new species.

Of course, the question is not yet settled. I only took up this instance in order to show how incomplete our knowledge is. Large tracts of the country are poorly or not at all known, and in addition, the knowledge of the morphological details is often defective. It would not be astonishing, if finally it should be found that *Ibidium odoratum* runs through *I. incurvum* into *I. cernuum,* but for the present all these forms are morphologically well separated, a separation which corresponds, at

[7] "Some Notes on our Yellow Cypripediums," *Rhodora,* 8, 1906, pp. 93, 94.

[8] According to Britton and Brown, "Illustrated Flora of the United States," 1, 1896, p. 471: Nova Scotia to Ontario and Minnesota, south to Florida and Louisiana.

[9] *Ibid.:* North Carolina to Kentucky, Florida and Louisiana.

[10] *Annals Carnegie Museum,* 3, 1906, p. 483.

least in part, to geographical segregation. If further studies should show that there is segregation, geographical or ecological, between these forms, then they are *species;* if not, they are *varieties,* which fact then also will be expressed in their morphological condition, one form running into the other at least in certain parts of their ranges.

A. E. ORTMANN

CARNEGIE MUSEUM,
PITTSBURG, PA.,
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SPECIAL ARTICLES

CARBOHYDRATE METABOLISM

WHEN we consider the fact that the products of the oxidation of sugars *in vitro* are not well known, the uncertainty that prevails regarding the mechanism of utilization of the common sugars in the body can be understood. Not only are the products of their metabolism unknown, but the form in which the carbohydrate must reach the cell to be available as a food is also not beyond dispute. It is ordinarily held that the cell can utilize sugar as such. On the other hand, some hold that the sugar must reach the cell in a colloid form or combination to act as a food. Again, it is claimed that dextrose is the form in which sugar is utilized by the tissues, and that the other sugars, as levulose or galactose, are transformed into dextrose before they are oxidized. The present preliminary report aims to give the results of some work on this problem.

The method adopted consists essentially of perfusing an organ with blood containing a known quantity of the sugar under investigation, and determining the loss after perfusion. The weight of the organs before and after perfusion is taken into account; the loss in volume of the perfused liquid; the gain in weight of the organ and the total carbohydrate before and after perfusion. In this way the quantity utilized by the organ may be determined. Perfusion was also done in dead organs to see that the mechanical construction had nothing to do with the loss of sugar. Also samples of the liquid were kept at the temperature of the perfused blood (37–40° C.) during the time of perfusion to ascertain the extent of glycolysis occurring without perfusion.

A very brief summary of results will be given:

Experiment I.—Perfusion of the hind legs of a dog with dextrose-blood solution. The legs were stimulated at 30 times per minute and the perfusion was made at the rate of about 125 c.c. in ten minutes.

	Dextrose per mille.
Blood before perfusion	3.1916
Blood after 20 minutes	2.9659
Blood after 30 minutes	2.7750
Blood after 45 minutes	2.4736
Blood after 65 minutes	1.9473
Blood after 71 minutes	1.5384

It is readily seen that a loss of sugar has taken place. This loss could occur in one of several ways: (1) by actual oxidation; (2) by accumulation in the surrounding tissues; (3) by storage in the tissues as glycogen, etc.; or (4) by absorption by the tissues. As a result of a number of experiments it has been found that both oxidation and accumulation take place. In every instance there was a distinct loss of dextrose when perfused through the living tissue. The accumulation by edema and other means increased as the tissues died, and in the dead organs an accumulation took place without any oxidation.

When the liver was perfused, there was likewise a loss of sugar. No glycogen storage occurred unless the perfusion was commenced very rapidly after the interruption of the circulation. In other words, the glycogen-storing function of the liver was lost much more quickly than the glycolytic function. No definite conclusions could be drawn as to the influence of the hepatic circulation when perfusion was made through the hepatic artery, simultaneously with the perfusion through the portal, the ordinary method used.

The utilization of levulose: What has been said of dextrose will hold good for levulose. A brief summary of results with this sugar will illustrate.

Weight of perfused leg	1,000	gms.
Weight of muscles of same	610	"
Weight of opposite leg	1,020	"