Vision and Localization during Rapid Eye Movements: R. S. Woodworth.

The author sought to show that vision occurs during movements of convergence, and also in rapid 'jumps' of the eye from one fixation point to another. The latter fact is best shown by the clear vision of a rapidly moving object that occurs when the eye moves in the same direction and with the same speed as the object. This can not be explained, as has been attempted, by supposing that only an after image of the impression received during the eye jump comes to consciousness, for the object is not only seen, but correctly localized in space.

The Measurement of Scientific Merit: J. McKeen Cattell.

A method was explained by which it was possible to select a group of the leading 1,000 men of science of the United States for the study of individual differences and by which degrees of scientific merit could be measured. The more eminent scientific men are distributed in accordance with the positive half of the curve of error, the first hundred differing among themselves about as much as the next two hundred or the last seven hundred. Data were also given in regard to the distribution of scientific men, including their birthplace, their place of residence and the institutions with which they are connected.

Temperament as Affecting Philosophic Thought: Brother Chrysostom.

It was urged that the temperament of a philosopher was so potent a factor in determining his emphasis of certain doctrines, his introduction of illogical views and his personal influence in the founding of his school, that it must be considered in order to understand his philosophy. Heredity, environment, race, epoch, the personality of the philosopher and of the master who first influenced him, were mentioned as elements in the temperamental complex that determines the cast of his thought.

Are Mental Processes in Space? W. P. Montague.

The paper consisted in a protest against the current view of mental processes as real occurrences that occur nowhere, and an attempt to show that they could exist in space without being either punctiform or figured (compare sounds and odors), and without displacing matter or being wedged into the spaces between material particles (compare stresses, velocities and accelerations). Potential energy, like mental action, exists in space without being visible and without displacing matter. Both are localized intensive states; and it was suggested that mental processes may be forms of potential energy into which the kinetic energy of the nerve currents must be transformed in order to be redirected.

R. S. Woodworth,
Secretary.

DISCUSSION AND CORRESPONDENCE.

THE THEORY OF ISOLATION AS APPLIED TO PLANTS.

President Jordan, in his opportune and clearly stated paper on 'The Origin of Species through Isolation,'[1] has suggested the following as a general law:

> Given any species in any region, the nearest related species is not likely to be found in the same region nor in a remote region, but in a neighboring district separated from the first by a barrier of some sort.

This we were inclined to accept as applicable to plants with little or no hesitation.

For several years the writer has studied, more or less critically, the plants of a well-defined floral region, and it has almost invariably been his experience that the difficult problems which confronted him were not the discrimination of the various species of a given locality or region, but the question of the relationship of his plants to similar forms occurring in another, usually adjoining, territory.

Consequently it was with considerable surprise that we read Professor Lloyd's[2] bold assertion that, if the general law stated by President Jordan were put in the converse form, 'it would be more in harmony with the facts in the case as understood by the botanists.'

In addition to the general and 'sweeping'

[1] Science, II., **22**: 545–562. November 3, 1905.
[2] Science, II., **22**: 710–712. December 1, 1905.

statements Professor Lloyd has offered a few specific illustrations, as well, to uphold his point, and, if we infer correctly, these are chosen from a great number of cases which he considers applicable. We naturally assume, therefore, that they are examples which he thought most conclusive. How well these really substantiate his assertions, however, can only be ascertained by carefully considering the merits of each illustration. And in doing this two predominant questions must be kept clearly in mind: (1) Are we dealing with the *most closely* related species? (2) Are the two species growing associated under the same conditions?

Viewed from this standpoint some of Professor Lloyd's illustrations not only do not agree with his assumption, but offer excellent examples of the general law suggested by President Jordan. For instance, *Viola lanceolata* and *V. primulæfolia,* we are led to infer, are associated with each other in the same habitat, a fact upon which at least one well-known authority is very skeptical. But, granting that they do so occur, are they more closely related to each other than to some other species? Three students of the genus whom I have consulted are unanimous in the opinion that they are not. On the contrary, *V. lanceolata* has its closest relative in *V. vittata* of the gulf states, while *V. denticulosa,* also of the southern region, holds a similar relation to *V. primulæfolia.* Both *V. lanceolata* and *V. primulæfolia,* therefore, have their closest relatives not associated with them, but growing in adjoining regions, separated by one of nature's well-marked barriers, that of temperature.

Again, *Rhodiola integrifolia,* it is claimed, occurs associated with *R. polygama* in Colorado, a statement which, it is true, we are unable to refute; but one of the recognized authorities of this genus does not hesitate to assert that *R. alaskana* and not *R. polygama* is the species nearest *R. integrifolia.* Both of these occur in Alaska, but there, too, is the barrier intervening; for while *R. integrifolia* is an alpine plant, *R. alaskana* is confined to the coastal region.

Fern students will not agree that *Dryopteris marginalis* and *D. goldiana* are the two more closely related species in that group. On the contrary, *D. goldiana* is usually considered most closely related to that far northern and western plant known as *D. filix-mas.*

If the opportunity were afforded and if we were able to gather the necessary data doubtless nearly all of Professor Lloyd's examples would be found fully as misleading. Enough have been refuted, however, to clearly show that we are not to accept his statements as at all conclusive.

Furthermore, our fellow botanist states, as his opinion, that it is easier to find exceptions to President Jordan's rule than facts in support of it. With this assertion we believe it absolutely impossible for any botanist to agree who is at all familiar with plants in the field, or who has ever given the question of geographical distribution any serious consideration. The writer most assuredly does not find that difficulty. Many cases among the plants with which he is most familiar in the field are brought to mind; some of which he will take the liberty of presenting for the careful consideration of those interested in this general discussion.

It may be well to state in the beginning that the examples chosen are limited mainly to the flora of the California province, partially because the writer is more familiar with the plants of that region, but also because the barriers are more clearly defined there and can be more readily appreciated.

Among the conifers of the Pacific coast are several suggestive illustrations of the isolation theory. For instance, we find *Pinus contorta* along the northern seacoast, while on the mountains is its very near relative *P. murrayana.* Again, *Pinus ponderosa* of the Pacific slope is represented in the Rocky Mountains by *P. scopulorum. Pseudotsuga mucronata* is replaced in southern California by *P. macrocarpa,* while *Cupressus macrocarpa* of Monterey Bay and *C. goveniana* of the northern coast ranges of California are two closely related species.

Castanopsis chrysophylla of the coast ranges has its nearest relative in *C. sempervirens* of the Sierra Nevada. The same may be said

of *Garrya rigida* and *G. fremontii,* and a host of others.

The genus *Rhamnus,* as represented on the Pacific slope, offers some excellent illustrations. *Rhamnus californica* of the coast ranges of central California has at least two very near relatives occurring in adjoining regions. *R. purshiana* of the northwest region and *R. tomentella* of the foothills of the Sierra Nevada and southern California. And, as we would naturally suspect, from the theory of isolation, the species occurring in central California is the intermediate one.

Ceanothus integerrimus (*C. andersoni*) of the Santa Cruz Mountains, *C. nevadensis* of the Sierra Nevada and *C. puberulus* of the San Bernardino Mountains are three very closely related species occurring in three different mountain ranges of the California province.

Adenostegia rigida of the coast ranges of central California, *A. filifolia* of southern California, and the Sierra Nevada form, not yet clearly defined, but bearing the name *A. rigida brevibracteata,* are, also, three very closely related species, clearly marked in the more isolated portions of their ranges, but apparently intergrading where the three ranges converge.

In southern California may be found other illustrations fully as conclusive. The flora of this region is naturally very similar to the more typical Californian flora, but it also has certain affinities with that of the Arizona region. Here occurs *Quercus engelmanni,* and it is in the Arizona region that we find its closest relative, *Q. oblongifolia.* Again, *Euphorbia palmeri* is represented in Arizona by *E. palmeri peplifolia* and *Ceanothus palmeri* by *C. myrianthus.*

The coastal and desert regions of southern California also present some well-marked examples. In this connection we need only suggest *Eriogonum fasciculatum* and *E. polifolium, Stenotus linearifolius* and *S. interior, Bebbia juncea* and *B. aspera.*

On the mesas about San Diego is the very common shrub, *Adenostoma fasciculatum obtusifolium,* which is wholly replaced northward by the typical form. Again *Calochortus weedii,* also limited to the same general region, is replaced by *C. weedii purpurascens* in the vicinity of Los Angeles and Santa Barbara.

In the above illustrations it will be noted that the species selected are very closely related. Some may be inclined to criticize this and it may be argued that the plants mentioned are, at least in some cases, not distinct species. This we are perfectly willing to admit as plausible. They may be only subspecies; but they are, nevertheless, just as suggestive of the isolation theory.

We do not wish it understood, however, that we consider isolation the direct cause of the origin of species; but, whatever the cause, we do maintain that the evidence in favor of isolation as an important factor in the *perpetuation* of closely related species is almost overwhelming in plants as well as in animals. And any theory of evolution which will not allow for this fact can not possibly prevail.

LeRoy Abrams.
United States National Museum.

GROUND ROCK FOR FERTILIZING PURPOSES.

To the Editor of Science: For several years the Division of Tests which is now attached to the Office of Public Roads has been investigating, in connection with the study of macadam road materials, the cause of the binding power of rock dust. These investigations have led to the conclusion that the decompositions that take place in rock powders under the action of water, when in a very fine state of subdivision (180-mesh and finer), and especially when the grinding has been done wet, bear upon a great many practical problems, some of which are of the very highest importance.

It appeared in fact that many of the feldspathic rocks which are more or less rich in potash might be made directly available as a fertilizing material. Although somewhat out of the line of experimentation of this office, under proper authorization the writer conducted a series of experiments on tobacco seedlings which showed that fine-ground orthoclase was very nearly, if not quite, as efficient as a source of potash plant food as the more