body, primordial germ cells included, since they are subject to the coordinating mechanism of the organism.

On this basis there can be no possible question of the association of somatic characters with the germ-cells. It has been shown that any character which has significance in evolution is already a part of the heritage at least to the extent that it is a product of inherited functional capacity responding to some condition within or without the organism. If we are justified in the interpretation of the functions of genes here expressed, any change in functional capacity accruing from use or disuse is no less a part of the heritage.

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TYPE CULTURES

A COMPLETE catalogue has been issued by the American Type Culture Collection. This catalogue can be obtained upon request to the Curator, American Type Culture Collection, John McCormick Institute for Infectious Diseases, 637 S. Wood Street, Chicago, Illinois. The collection now contains about 1,450 cultures including 256 fungi and 200 yeasts. A charge is made for cultures to help defray the cost of maintaining the collection.

L. A. ROGERS
Chairman, Executive Committee

THE ORIGIN OF THE PRAIRIE

A PHENOMENON heretofore unsatisfactorily explained by scientists is the occurrence of the natural grasslands of the Middle West, particularly the extensive prairies of Illinois, Indiana and Iowa. Though most of the theories advanced explain their existence altogether in terms of present physical conditions, I am convinced that rapid drainage prevailing at the time of their origin is a determining factor in their development.

It is generally agreed that lakes or marshes are destined in the course of time to become either forest or prairie. One of the factors which may determine which of these shall be the ultimate stage has not been reported. It has come to my observation that if lakes or marshes are drained quickly prairie develops, if drained slowly forest develops. This relationship occurred to me after I had observed small ponds in Albemarle County in Piedmont, Virginia, for a period extending over twenty-five years. One pond observed was that on my father's land near North Garden, Virginia, which was built in 1888 by filling the lower end of a rayine with dirt and pine brush. This ravine contained a small stream which rose at the foot of a forest made principally of poplars (*Populus balsamifera*), black locust (*Robinia*), white (*Quercus alba*), red (*Quercus rubra*) and black (*Quercus velutina*) oaks. The pond, however, was more directly surrounded by a jack pine (*Pinus virginiana*) forest. Black porters loam soil had been washed down into the pond from the forest mentioned first until there was a deposit of two and one half feet and the pond was then left two feet deep. In the summer of 1904 the dam of the North Garden Pond was broken by a storm. The succeeding vegetation was grass, in which no seedling trees appeared. Though the dam was rebuilt in 1905, since then the pond has been neglected. Due probably to slow leakage caused by crayfish, the water level of the dam has been gradually falling. Following this gradual drainage, the exposed edges have been passing through the willow (*Salix nigra, Salix longifolia*) and cattail (*Typha*) into the pine (*Pinus virginiana*) stage without the intervention of grass.

Another pond observed through a period of years was the Coles Pond on top of Green Mountain, 1,000 feet above sea-level, and surrounded by a virgin oak forest consisting mainly of white (*Quercus alba*) and black (*Quercus velutina*) oaks. The pond was made by an artificial mound of dirt between two hills. When I first saw this pond in 1901 it was covered with coarse grass. Mr. Butler, the manager of Stutsville (the name of the farm), informed me it was broken two years previously by the water after a thunder storm. Mr. Butler refilled the pond in the fall of 1901. Since then it has been gradually drained by seepage. Algae first appeared on the edges such as *Oscillatoria, Spirogyra, Oedogonium* and *Vacheria,* followed by mosses on the edge, but not sphagnum. As the water level dropped, these were replaced in the following sequence: cattail (*Typha*), bottombush (*Cephalanthus occidentalis*), black willow (*Salix nigra*), sand-bar willow (*Salix longifolia*), maple (*Acer saccharinum*), jack pine (*Pinus virginiana*), and at the present time the black oak (*Quercus velutina*), red oak (*Quercus rubra*), sassafras, *Vertifolium,* intermingled with wild grape (*Vitris vulpina*).

Recently, further study under Dr. H. C. Cowles in the Chicago region has provided additional data. Prairies, for example, are developing to-day from Calumet Lake near Chicago. Sedges are encroaching rapidly upon the bulrushes as the new soil is gradually raised higher and higher above the lake, and in turn the encroaching of grasses upon the sedges is resulting in a prairie. Skokie marsh and hog marsh are also undergoing transformation of this character. Sometimes with the prairie grasses are a number of coarse xerophytic herbs, largely composites (*Silphium laciniatum, S. terebenthinaceum, S. integrifolium, Lepachys, Solidago rigida, Aster, Liatris*), with legumes (*Amorpha canescens,* Petalostemon, Melilotus, Baptisia), and Eryngium, Dodocatheon, Phlox and *Allium cernuum.* These prairies are being formed from the basin of the former glacial Lake Chicago.

The formation of natural grass and forest regions in the Chicago region may be explained by a study of its glacial history. While the edge of the ice in the last advance was being melted back to the Valparaiso moraine and while it remained there, glacial water flowed off to the south. From northern Illinois this found its way by various valleys to the Mississippi. As the ice retreated farther to the northeast of the Valparaiso moraine, the depression between the ice front and the morainic ridge was flooded with the glacial water. The Lake Chicago so formed gradually enlarged as the edge of the ice retreated. Its waters rose until they reached a level of about sixty feet above the present surface of Lake Michigan.

At this stage Stony Island was completely submerged. When the outlet of Lake Chicago was lowered, it entered upon a second stage twenty feet below the first, but Stony Island was still under the water. As the outlet was lowered further the lake level fell to the third stage (the Tolleston stage), which exposed the very top of Stony Island. By the breaking of the waves a beach ridge was formed on top of the island and at this time the forest began its growth. Then when the ice sheet melted away and an outlet was established by way of the St. Lawrence Valley, the old lake fell to the present level of Lake Michigan, and the surroundings of Stony Island became land. These surroundings, rapidly drained, are to-day grassland, while Stony Island itself is practically covered with forest.

I believe furthermore that the grasses in the prairies are not a climax stage, but that the forests are gradually encroaching upon them. This process is very slow because the grass, when once firmly established, forms a mat which prevents the seeds of trees from getting into the soil and germinating. There are conditions, however, which aid the forest seeds in securing a place in the grass-covered soil. For example, disturbances of that mat are caused by man's digging or plowing, horses pawing the earth and erosion by running water. If tree seeds once fall in such places they will germinate and if undisturbed will grow. This would explain the presence of trees, either in patches or scattered throughout an area once covered with grass. Indeed, the savannah may be accounted for in such a manner.

The help of eroding forces in the formation of forest may be further shown by observation of sand dunes. Here the instability of the soil is preventing the grass from forming a mat, and forests are slowly encroaching upon the dunes, securing a foothold before a grass mat can be formed.

In view of the above observations, I am of the opinion that the natural prairies of the Middle West are due not to present physical conditions but to rapid drainage at the close of the ice age. Further I believe that the grass stage thus formed is not the climax, but that trees are slowly invading the prairie, being aided in their progress by erosive processes.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE PREPARATION OF COPPER HYDROSOL AND ITS USE IN ELECTROPLATING OF GLASSWARE[1]

SOME time ago the author found it necessary to copper plate the bore of some capillary tubing. For technical reasons, a basic layer of another metal or of graphite was undesirable, even had it been possible to apply the latter. Cathodal deposition was also out of the question.

By employing hydrazine hydroxide as a reducing agent a suitable copper hydrosol was prepared. Gutbier found hydrazine hydroxide in 1–4,000 dilution sufficient for formation of the blue gold hydrosol[2] but since copper is immediately below hydrogen in the electromotive table a much stronger solution was found necessary in this case.

Method.—An article to be plated is well cleaned—that process followed by Brashear in his silver plating method[3] should be satisfactory. It is then placed in a receptacle of just sufficient diameter to accommodate it and covered with a 50 per cent. aqueous solution of hydrazine hydroxide. (It is not necessary to prepare this from the salt—it appears to keep indefinitely when placed in the dark. After some months there may be a faint odor of ammonia, but there is no appreciable reduction in concentration.) To this is added, drop by drop and with constant vigorous shaking, a 5 per cent. solution of cupric sulphate until a deep golden suspension of colloidal copper is obtained. One or two drops of excess are then added and metallic copper is de-

[1] From The Hull Physiological Laboratories of The University of Chicago.

[2] Gutbier, *Zeit. für Anorg. Chem.* 1902.

[3] Brashear, Miller's Laboratory Physics. Ginn & Co.