New York Meeting.

College of Physicians and Surgeons, Columbia University, December 15, 1926.

3307

The Effect of Selection on the Rate of Reproduction of Paramecium Aurelia.

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The work of Jennings[1] affords much evidence that, in *Paramecium,* morphological differentiations, which are hereditary, do not arise in a line reproducing vegetatively. As a result, selection is powerless to isolate hereditarily different strains among the descendants of a single cell. On the other hand, the same author[2] has shown that in the uniparental reproduction of a rhizopod, *Difflugia corona,* the number and length of the spines on the test, as well as other morphological characters, become differentiated in the descendants of a single individual; and that by selection it is possible to isolate many hereditarily different strains.

The effectiveness of selection in regard to what may be termed a physiological character has not been tested in *Paramecium,* but Middleton[3] has undertaken this in a study of the fission rate of another ciliate, *Stylonychia pustulata.* This author found that "by opposite selection, through more than 150 generations, of small individual variations occurring among the progeny of a single individual, it was possible to produce two sets differing hereditarily in rate of fission." The hereditary difference persisted through periods of balanced selection, and through conjugation, and disappeared only under the influence of reversed selection.

In view of the above results a series of experiments were carried on which involved the selection of a physiological character in *Paramecium.*

Although there is a remarkable synchronism of fission in closely related cells of a race of *P. aurelia*, under identical conditions, frequently one cell will divide slightly earlier than the others. This variation in the rate of division of individual cells is the physiological character which was selected in our experiments.

TABLE I.

A—Opposite Selection—200 days.
'Fast' lines 262 generations.
'Slow' lines 196 generations.
Difference in favor of fast, 66 ± 1.20.

A Opposite Selection		A_1 Balanced Selection		A_2 Reversed Selection	
225 days		225 days		225 days	
'F' lines	298	'F'-Bal. lines	295	'F'-Rev. lines	295
'S' lines	220	'S'-Bal. lines	219	'S'-Rev. lines	223
Difference	78 ±1.75	Difference	76 ±1.15	Difference	72 ±1.23
250 days		250 days		250 days	
'F' lines	336	'F'-Bal. lines	326	'F'-Rev. lines	327
'S' lines	236	'S'-Bal. lines	237	'S'-Rev. lines	244
Difference	100 ±1.70	Difference	89 ±1.89	Difference	83 ±2.94
275 days		275 days		275 days	
'F' lines	371	'F'-Bal. lines	361	'F'-Rev. lines	348
'S' lines	258	'S'-Bal. lines	261	'S'-Rev. lines	267
Difference	113 ±2.11	Difference	100 ±2.77	Difference	81 ±4.62
300 days		300 days		300 days	
'F' lines	401	'F'-Bal. lines	391	'F'-Rev. lines	375
'S' lines	275	'S'-Bal. lines	272	'S'-Rev. lines	286
Difference	126 ±3.27	Difference	119 ±2.16	Difference	89 ±3.84

The experiments summarized in Table I extended over a period of 300 days. From the progeny of a single animal eight lines were isolated; four of these lines were subjected to what might be referred to as a fast, or plus, selection over this period, the other four to slow, or minus, selection. At the end of 200 days the two sets showed a marked diversity in the rate of fission. The fast set attained an average of 262 generations, the slow set 196 generations. As indicated in the table, there was a very significant difference of 66±1.20 generations between the fast and slow lines at this time.

At the 200-day point two sets of sister animals were isolated from each of the A lines. One set of eight lines (A_1) was subjected to balanced selection (which amounts to no selection) for 100 days. That is, each plus selection was followed by a minus selection, at the next opportunity, and *vice versa*. Another set of eight lines (A_2) was isolated from the main diverse lines of A, and upon this was practiced reversed selection. That is, the fast lines were now subjected to slow or minus selection, the slow lines to fast or plus selection.

During this period of 100 days opposite selection was continued in the main (A) lines until we have a difference of 126±3.27 generations between the fast and the slow lines. Throughout this same period the lines subjected to balanced selection (A_1) maintained a difference in division rate of 119±2.16 generations, while the difference in the case of the reversed lines (A_2) had dropped to 89±3.84. Thus (taking into consideration the probable error) we find that this difference, which was cumulative, has persisted through the period of balanced selection, but tends to disappear under the influence of reversed selection. Selection has apparently been effective in establishing two diverse sets, differing in regard to the physiological character, division rate.

A more detailed analysis of these experiments will be presented in another paper. The effect of selection is now being studied in *Paramecium calkinsi,* a form which differs from *Paramecium aurelia,* in that endomixis has never been demonstrated, and apparently does not occur. The experiments are also being repeated on the hypotrich, *Stylonychia pustulata,* for the purpose of comparison with the two holotrichous forms mentioned above.

[1] Jennings, H. S., *Proc. Am. Phil. Soc.*, 1908, xlvii, 393.
[2] Jennings, H. S., *Genetics*, 1916, i, 407.
[3] Middleton, A. R., *J. Exp. Zool.*, 1915, xix, 451.

3308

Diabetes Mellitus: An Experimental Study on the Etiology of the Disease.

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A survey of the literature gives no convincing evidence that the disease is caused by bacteria. It seemed possible that it may be caused by a filterable virus.

Experiments were made on rabbits to determine whether it is possible to obtain evidence of the presence and action of a filterable virus. It seemed probable that the causative organism is thrown off from the patient's body in the urine. The urine of diabetic patients was therefore passed through Berkefeld filters, and the filtered urine was injected into the circulation of rabbits in doses of