K, 50 p.p.m., and (4) P, 100 p.p.m.-K, 50 p.p.m. Treatments were based on parts per million of elemental phosphorus supplied as $Ca(H_2PO_4)_2 \cdot H_2O$ and elemental potassium supplied as KCl. The soil, when gathered from the field, was deficient in nitrogen, phosphorus and potassium. Commercial seed was surface sterilized, inoculated as desired, and planted, ten seeds to each pot, in steam-sterilized, limed (to pH 6.5) soil. Five-inch pots were used as containers. The experiment was set up in seven randomized blocks. The pots were seeded on April 19, 1941, and harvested on July 15, 1941. Total dry weight and total nitrogen content of the plants were measured.

TABLE I

Culture	Gms. dry wt. produced* in soil fertilized as indicated				Mgs nitrogen produced* in soil fertilized as indicated			
	None	P, 100 p.p.m.	K, 50 p.p.m.	P, 100 p.p.m.-K, 50 p.p.m.	None	P, 100 p.p.m.	K, 50 p.p.m.	P, 100 p.p.m.-K, 50 p.p.m.
209 ...	21.5	19.3	21.5	24.9	515	463	478	604
238 ...	19.3	17.9	22.5	25.5	455	427	500	584
239 ...	18.8	17.5	24.6	27.3	448	414	557	648
H	18.3	16.7	24.0	26.3	461	416	562	636
D	15.5	15.1	19.8	19.4	293	323	419	432
No culture	16.3	15.0	17.1	18.1	307	298	330	324

* Total from the seven replications.

The results of this second experiment (Table I) confirmed the suppositions made from the data of the first experiment. The dry weight and total nitrogen content of plants inoculated with cultures 209 and 239, with and without the addition of potassium, may be taken as an example. When inoculated with culture 209, plants produced a somewhat greater total dry weight and total nitrogen content in unfertilized soil than plants inoculated with culture 239. However, when inoculated with culture 209 dry weight and total nitrogen content of plants do not increase as a result of fertilization with potassium, whereas the increase in dry weight and total nitrogen content of plants inoculated with 239 is quite appreciable. From this it appears highly probable that culture 209 is better adapted to fix nitrogen in potassium deficient clover than culture 239, whereas 239 is better adapted to fix nitrogen in well-nourished plants than is 209. This single example suffices for the purpose of this report.

An analysis of variance of the data on dry matter produced, and subsequent calculation of the mean squares for individual degrees of freedom for interaction between culture and fertilizer treatments, indicates that in the example used above differences are highly significant. In the data on total nitrogen content of the plants, differences in the example cited are highly significant if the data relative to plants inoculated with cultures 209 and 239, with and without potassium, are isolated from the remaining data and analyzed. This procedure is believed justified since there are heterogeneous factors contributing to experimental error in the nitrogen data. For example, several plants receiving no inoculum became contaminated, thus raising the per cent. nitrogen content unduly high. Contamination was less likely in the inoculated groups of plants.

There is no evidence that fertilization with phosphorus changed the relative order of efficiency of the cultures studied.

The occurrence of strains of Rhizobia particularly well adapted to potassium deficient plants is not unexpected in view of what is known of the behavior of Rhizobia. Wilson, Burton and Bond,[2] as well as others, have previously shown that strains of Rhizobia differ in their adaptation to physical and chemical conditions prevailing in given varieties of leguminous plants. For example, two strains of Rhizobia may be of comparable efficiency on one variety of a leguminous plant but differ greatly in their efficiency on another variety of the same species of leguminous plant. However, it seems to us that the demonstration of cultures especially suited to potassium deficient plants has added significance because it suggests the possible development of commercial inoculants especially suited for use with legumes to be grown on particular soil types.

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THE EFFECT OF ARTIFICIAL CHANGES IN THE BRAIN OF MAZE-LEARNING IN THE WHITE RAT

ONE of the authors has published a number of papers[1, 2, 3, 4] on the effect of injections of the pituitary growth hormone (Antuitrin G and Phyone) in tadpoles and in pregnant white rats on the proliferation of brain cells in the young. In general the mammals at birth showed an increase of about 36 per cent. in weight of the cerebral hemispheres, but only about 19 per cent. in body weight. This differential is further emphasized by the fact that the number of cells per volume of cortex increased 86.5 per cent. over that of the controls. Moreover, the increase in volume was

[2] P. W. Wilson, J. C. Burton and V. S. Bond, *Jour. Agr. Research*, 55: 619, 1937.

[1] S. Zamenhof, "Possibilities of Increasing the Higher Functions of the Cortex," pp. 1–28. Lancaster: Science Press, 1940.

[2] *Idem, Growth*, 5: 123–139, 1941.

[3] *Idem, Nature*, 148: 3744, 143, 1941.

[4] *Idem, Physiol. Zool.*, 1942. (In press).

70.4 per cent., and that in density 9.27 per cent. All these increases are statistically significant. In those animals that reached maturity (3 to 4 months), the total number of cortical neurones was 38–40.6 per cent. greater than that of the controls. The corresponding figure for cell density was 14.8–27.6 per cent.

The question arose as to whether or not this increase in the number of cortical neurones, when produced artificially, would lead to an increase in maze-learning performance. A maze of 12 culs-de-sac of the Warner-Warden design[5, 6] was used. The experimental group consisted of 9 males and 7 females, and were the progeny of mothers that had been injected subcutaneously each day, from the 7th to the 18th or 20th day of pregnancy, with 1 cc of the commercial preparation of the hormone. The control group consisted of 13 males and 9 females, reared under normal conditions. The animals were approximately $2\frac{1}{2}$ months old when tested, and were of the Sherman strain, secured from the Department of Animal Care, College of Physicians and Surgeons, Columbia University. The total number of cortical neurones showed an increase in the experimental group of 38.4 per cent. in the males and 40.6 per cent. in the females. The cell count was made when the rats were from 108 to 124 days old. There was no significant increase in brain weight, body weight or in the thickness of the cortex.

The increase in the number of cortical cells was not effective in speeding up maze performance. The male experimental group required somewhat fewer trials, and made somewhat fewer errors, but the differences were not statistically significant. The females, on the other hand, learned the maze somewhat less readily than the female controls. We must conclude, therefore, that the artificially produced cells have little or no effect on maze behavior. This conclusion should be corroborated by tests on larger groups before it is accepted finally. It is possible, of course, that such an increase in cortical neurones might be effective in a task representing a higher level of intelligence than maze-learning ability.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A PETRI DISH HOLDER FOR MECHANICAL STAGES

WORK in these laboratories has shown the need of a holder which will enable a Petri dish to be moved around under the microscope by the smoothly controlled action of the mechanical stage, thus facilitating observation and expediting such operations as delicate dissection or the precise removal of minute material. Obviously such an appliance must fulfil certain requirements. It must permit rapid easy insertion or removal of the dish, whether base down or inverted, whether covered or open, yet must hold the dish firmly and move it smoothly and precisely around on the microscope stage. It must fit the various types of mechanical stages in common use yet permit their full range of mobility so that any part of the dish may be centered, save, perhaps, the extreme periphery of the four-inch size.

To meet these requirements, as various manufactured devices proved inadequate, the writer, three years ago, developed a device which has served satisfactorily through extensive use in these laboratories ever since.

This holder consists essentially of a spring-steel clip which firmly clasps the dish, and is carried by a frame that fits snugly into the slide holder of the mechanical stage (Fig. 1, A). For the clip, the most exacting

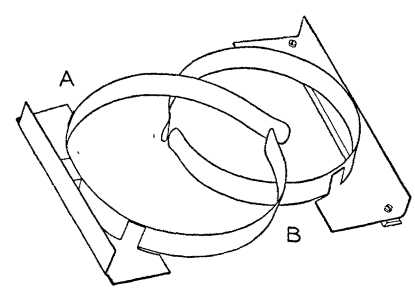

FIG. 1

part of the device, the chromium-plated steel springs sold by photographic supply stores for clipping over reels of 16 mm movie film have proved most satisfactory since they have adequate strength and a width ($\frac{1}{2}$ inch) suitable to the height ($\frac{1}{2}$ to $\frac{5}{8}$ inch) of the common 3- to 4-inch dishes. For smaller Petri or Stender dishes, pieces of clock springs or of bicyclists' trousers clips are also suitable. The frame, of 16- to 20-gauge sheet brass, has a horizontal base about 3×1 inch to fit into the slideholder of the stage, with a crescentic aperture of a size to accommodate the dish

[5] C. J. Warden, T. N. Jenkins and L. H. Warner, "Comparative Psychology," Vol. I, p. 242. New York: Ronald Press, 1935.

[6] L. H. Warner and C. J. Warden, *Arch. Psychol.*, 15: 92, 5–27, 1927.