

age of the animal, and gestation unaccompanied by lactation, were comparatively negligible factors in the renal enlargement under the conditions of these experiments.

Blood urea determinations showed that in the nephrectomized control mother rats the values rose from a normal of 23-44 mg. per 100 cc. to 60-70 mg. during lactation, while the urea concentration for the rats on the high protein ration rose from the "normal" to 66-130 mg. after nephrectomy during pregnancy and to a content as high as 188 mg. during lactation. These high values were not due to changes in blood concentration in general.

A few of the rats which were subjected to the greatest reproductive strain and which were given the high protein ration for periods varying from 106 to 187 days, showed renal lesions comparable to those described by Moise and Smith.¹

4011

Further Studies on the Life History of *Blepharisma Undulans*.

LORANDE LOSS WOODRUFF.

From the Osborn Zoological Laboratory, Yale University.

Studies on the life history of *Blepharisma undulans* were carried on for just 6 years, all the animals employed being the progeny of a single individual isolated November, 1921. The work was planned to determine, in particular, the viability of this infusorian in the absence of fertilization, and the effects of fertilization on the rate of reproduction, in an attempt to broaden the results from our earlier studies on *Paramecium aurelia*¹ and *Spathidium spathula*.² A preliminary statement of the characteristics of this race of *Blepharisma undulans* was published in 1922,³ and a summary of the chief experimental results was presented in 1927.⁴

The present communication is to reiterate the results previously presented in the light of the final year of study of the culture.

In brief, the conclusions derived from *Paramecium* and *Spath-*

¹ Moise, T. S., and Smith, A. H., *J. Exp. Med.*, 1927, xlvii, 27.

¹ Woodruff, L. L., *Quar. Rev. of Biol.*, 1926, i, 436.

² Woodruff, L. L., and Spencer, *Proc. Soc. Exp. Biol. and Med.*, 1921, xviii, 240, 303; *J. Exp. Zool.*, 1924, xxxix, 133.

³ Woodruff, L. L., and Spencer, *Proc. Soc. Exp. Biol. and Med.*, 1922, xix, 339.

⁴ Woodruff, L. L., *Proc. Soc. Exp. Biol. and Med.*, 1927, xxiv, 769.

idium that these infusorians are capable of unlimited reproduction, under favorable environmental conditions, without recourse to fertilization, may now be extended to *Blepharisma*; and, furthermore, the conclusion that fertilization accelerates the division rate, as previously demonstrated in *Uroleptus*⁵ and in *Spathidium*,² may now be extended to *Blepharisma*.

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4012

An Experimental Study on Formation of Middle Ear in Rana.

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The otic vesicle of various species of *Rana* was extirpated completely and in part. In one series the ear was grafted homoplastically to the flank, and later regrafted to the orthotopic position. The animals were carried through metamorphosis, to study the effects of these operations upon the formation of the middle ear. It was sought to determine the extent which differentiation of the inner ear influences the formation of the plectrum and tympanum, and the periods at which this influence may be effective.

The operations were performed on the left ear. Equilibration was found to be abnormal, the larvae swimming in counter-clockwise spirals or in clockwise circles. The larvae at rest were found to lie upon the left side. Normal equilibration was regained in some of the older larvae, but a number of metamorphosed animals showed a sharp inclination of the head to the left.

The grafted ear vesicle differentiated more or less completely. In some cases considerable differentiation of the otoliths took place. Normal differentiation of the Anuran ear in heterotopic position has recently been described.

The metamorphosed animals had a fully developed tympanic membrane on the operated side. The *annulus tympanicus* was present. A plectrum was formed when but a small rudimentary ear was present, its medial end fused with the ear capsule, which showed no operculum. The tympanum and Eustachian tube were formed normally.

⁵ Calkins, G. N., *J. Exp. Zool.*, 1919, xxix, 121.