$$y = \frac{ca}{k\left(1 - \frac{c^2a^2}{k^2}\right)^{\frac{1}{2}}}\sqrt{\left(x + \frac{a}{1 - \frac{c^2a^2}{k^2}}\right)^2 - \frac{c^2a^4}{k^2\left(1 - \frac{c^2a^2}{k^2}\right)^2}} - \frac{ca^2}{k\left(1 - \frac{c^2a^2}{k^2}\right)^{\frac{3}{2}}}$$

$$\times \log\left\{\left(x + \frac{a}{1 - \frac{c^2a^2}{k^2}}\right) + \sqrt{\left(x + \frac{a}{1 - \frac{c^2a^2}{k^2}}\right)^2 - \frac{c^2a^4}{k^2\left(1 - \frac{c^2a^2}{k^2}\right)^2}}\right\} + c_2.$$

If our assumptions are correct, the above formula ought to represent adequately our growth curves. It was shown that the above formula can be transformed into the following forms as particular cases:

$$y = a + b \log (x + c),$$
$$\text{and } y = a + bx + c \log x.$$

These are formulas which are already extensively used for graduating observed growth curves. Thus there is no further need to test the adequacy of the formula to represent the growth curves, since numerous applications have been made with satisfaction and already published by various investigators. I therefore put forward the following provisional definition of growth considered as a process: "An organism tends during growth to form greatest amount of mass with least loss of growth capacity."

Further the present investigation furnishes a biological meaning to the logarithmic formulas which have been extensively used without appreciating the full significance of their properties.

The cases of abnormal growth were also discussed but will be treated more fully in a future publication.

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Experiments to modify the sex ratio in the toad.

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Several series of experiments were made in the spring of 1910 in order to ascertain whether the sex ratio in the toad can be altered by subjecting the eggs to different environmental conditions at or before the fertilization period.

Lots of eggs fertilized in various solutions of alcohol (.13 per cent. to 2 per cent.), as well as those fertilized with sperm from

the right or from the left testicle of three different males, all gave practically normal sex ratios as the proportion of females ranged from 46.92 per cent. to 55.64 per cent.

Three batches of eggs from two different females were fertilized out of water and kept in a moist chamber for several hours. Each batch of eggs gave an unusual excess of females, the proportion of females varying from 60.86 to 70.83 per cent.

Mature eggs from another female were subjected to the action of a 2.5 per cent. solution of salt or of cane sugar for ten minutes and then fertilized in tap water. In each case 70 per cent. of females was obtained. In this series of experiments, as well as in the preceding one, it is probable that the eggs lost water during the fertilization period or at least were prevented from absorbing water during this time.

Seven lots of eggs from four different females were fertilized in solutions of hydrochloric or of acetic acid, the strength of the solutions varying from .01 per cent. to .0025 per cent. In every instance the percentage of females obtained was from 10 to 20 per cent. lower than that which is probably normal for the species. Lots of eggs from the same females fertilized in alkaline solutions (NH_4OH or NaOH) of the same strength gave proportions of the sexes within the range of probable normal variations in the sex ratios of different lots of individuals. It is probable that the acid solutions caused the eggs to absorb an extra amount of water during the fertilization period. The alkaline solutions were apparently too weak to have any influence on the eggs.

No definite conclusions can be drawn from these experiments, since in every case the mortality was very great. The results strongly suggest, however, that in the toad, *Bufo lentiginosus*, sex is determined at or near the time of fertilization and that it can be influenced by external factors. They also seem to indicate that the relative amount of water in the egg at the time of fertilization has some influence in determining sex: an increase in the water content tending to produce a male; a lowering of the water content favoring the development of a female.