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Weight fluctuation in frogs.

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It is known that frogs lose weight when removed from water or very moist places and are placed in dry surroundings; and that gain in weight occurs under reversed conditions.[1] To test the magnitude of such change under local laboratory conditions, beginning in 1909, several series of experiments have been performed. Leopard frogs (*Rana Pipiens*) were used.

The first series were performed during June and July and the laboratory was not heated. During the day the windows were opened and the temperature varied from about 23.6° to 30.2° C. Night temperatures were not taken, but the minimum observed by the local weather bureau for the period was 16.7° C. Showers occurred during the experiment, so the air was not abnormally dry.

Placed in water and weighed hourly, a maximum hourly fluctuation of 10 per cent., a minimum 0, and an average for 10 hours of 3.8 per cent. was observed. A total gain in weight amounting to 20 per cent. occurred. Placed in wire cages in the air of the laboratory a very rapid loss of weight occurred, amounting to as much as 40 to 45 per cent. of the original weight in twenty-four hours. If the loss was not greater than this, recovery might take place if the animal were placed in water. The gain in weight was very rapid, the total weight within four hours amounting to as much as 121 per cent. of the original weight, or 200 per cent. of the weight after drying. During the next sixty hours, the weight fluctuated moderately, rising during the afternoon of the second day to 136 per cent. of the original weight before drying.

The time of death by drying is not very exactly shown by the experiments, owing in part to the sluggish reactions supervening. In one case the animal was alive thirty hours after being placed in the dry cage at which time the loss of weight amounted to 42

[1] Donaldson, *Jr. Compar. Neurol.*, 1898, VIII, 314. A. Durig, *Arch. f. d. ges. Physiol.*, 1901, LXXXV, 401; 1901, LXXXVII, 42; 1902, XCII, 293.

per cent., while seventeen hours later (over night), the animal was dead, and the loss of weight had increased to 56.4 per cent. of the original weight. This is rather larger than loss in weight compatible with life hitherto reported, but as it is known that the seasonal condition of the animals has an important bearing in such experiments,[1] and since the frogs employed were in the "winter" condition, the relatively great loss in weight before death is not considered extraordinary.

A frog in which the brain was pithed before placing in the dry cage lost 60 per cent. of its original weight in twenty-three hours,

The behavior of partially dried frogs when placed in hypo-, iso- and hypertonic salt solutions is interesting. In one such experiment, the original weight was 19 gm. and twenty-three hours after placing in a dry cage 11 gm. The frog was then placed in 0.2 per cent. NaCl solution. Fifty minutes later it weighed 18 gm., and seven hours later 25 gm. Twenty-four hours later the weight was 24 gm., from which point, with slight fluctuations. it gradually decreased until seventy-two hours after placing it in salt solution it was 22 gm. The animal remained lively.

Another frog weighing 18.5 gm. was allowed to dry until it weighed 11.8 gm., which took place within twenty-three hours. It was then placed in 0.6 per cent. NaCl solution. Fifty minutes later it weighed 16 gm., and seven hours later, 22 gm. Fifty-five hours after being placed in the solution, the weight was 28.2 gm., but seventeen hours later it was 24.5 gm. At this time the frog was alive and in good condition.

Another frog similarly dried and placed in 0.7 per cent. NaCl solution, showed a more gradual and less pronounced increase in weight, and was active and in good condition seventy-two hours later. Frogs dried and placed in 0.8 per cent., 0.9 per cent. and 1 per cent. NaCl solutions barely regained their original weight, and the process was much more gradual. They died soon after being placed in the NaCl, but in the case of 1 per cent. NaCl the animal lived for somewhat longer than seven hours. In stronger solutions, body weight was not regained, and death soon occurred.

Since it is known that water content influences tissue function, this note is offered with the view of directing attention to the

[1] Donaldson and Schoemaker, *Jr. of Comparative Neurology*, 1909, X, 109.

fact that under laboratory conditions the weight of frogs may fluctuate rapidly and extensively; and further, to emphasize the importance of adequate precautions to prevent such changes in physiological and pharmacological studies on frogs, especially when it is particularly important to preserve normal physiological reaction in the highest degree or in determining pharmacological dosage in relation to body weight.

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The sensory effect of local application of hypertonic salt solutions.

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While engaged in an investigation of certain effects of local application of salt solutions to exposed nerve trunks, and to nerve terminations exposed by abrading the skin, a paper appeared by Wiki,[1] in which results are presented and interpreted as showing that local anesthesia followed intracutaneous injections of solutions of various substances into guinea-pigs. A number of the salts employed by him were included among those used by us. Since the interpretation of an anesthetic action by him is at such variance with our results, it seems advisable to make a brief statement at this time.

Wiki states that strong solutions of magnesium chloride or sulphate when injected intracutaneously in the back of a guinea-pig produce marked anesthesia, as evidenced by decreased reflexes upon stimulating the affected skin area; while in our experiments, direct application of strong solutions of these salts to exposed nerve trunks (frog and turtle), abraded skin areas (human), or to the unabraded skin (frog), have resulted in very positive evidence of an irritant action. In the case of nerve trunks thoroughly isolated from surrounding tissue, a block may be produced by keeping the nerve bathed in a strong solution; but in the case of application to abraded or unabraded skin, though such applications have been continuously applied for twenty minutes or more, not one symptom of anesthetic action could be

[1] *Jr. de Phy. et Path. Gen.*, 1913, XV, 845.