

carbohydrate and 4 of 9 rats fed high fat diets survived until the end of the experiments. *In starved animals* a statistically significant qualitatively similar effect upon gland weights has also been obtained (Table III).

Attempts were made to determine the effect of adrenal cortical extracts[†] upon the change in the adrenal weights. The results were inconclusive using subcutaneous injections as high as 5 cc twice daily.

Discussion. The above data indicate a definite effect of prolonged exposure to low atmospheric pressure upon the absolute weights of the adrenal, thymus and testes. The pattern of change and the general condition of the animals was similar to that which may be produced by cold, injections of formalin or morphine, severe muscular work and other forms of stress (alarm reaction of Selye^{6, 7}). The effect of diet upon prevention or amelioration of the "alarm reaction" due to other agents has not been reported. However, in connection with the lack of effect of diet in our experiment it is well to point out the long time intervals between feedings.

Summary. Rats exposed to low atmospheric pressure for more than 2 days exhibited a significant increase in adrenal weight and a significant decrease in the weight of the thymus and testes. This pattern is similar to that found following other forms of stress. No significant effect of diet upon this change was demonstrated.

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A Method for Inducing Limb Regeneration in Adult Anura.

S. MERYL ROSE. (Introduced by Otto Glaser.)

From the Department of Biology of Amherst College.

It has been demonstrated by Barfurth¹ and confirmed by subsequent investigators that frogs apparently lose their ability to regenerate limbs during the tadpole stage. On the other hand, a few adult frogs² and toads³ have been observed with very definite indications of limb regeneration. These few cases of regeneration in adults are rare. Usually the stumps heal without regenerating.

[†] We are indebted to Dr. George F. Cartland of the Upjohn Company for the adrenal cortical extract.

¹ Barfurth, D., *Arch. f. Entw.-Mech.*, 1894, **1**, 117.

² Gadow, H., *Amphibia and Reptiles*, The Cambridge Natural History Series, 1901.

³ Woodland, W. N. F., *Q. J. M. S.*, 1921, **65**.

A method of inducing limb regeneration in tadpoles too old to regenerate, after simple amputation, has been described by Polejaiev.⁴ His method involves injury to the stump by cutting. Since *Tubularia* does not regenerate unless a cut surface is maintained where exchanges occur between tissue and environment⁵ and since urodele limbs fail to regenerate when the amputation surface is covered by epidermis,⁶ the following experiment was performed. The normal irritation following amputation was prolonged in *Anura* by baths in a saturated sodium chloride solution.

Parts of limbs were removed from *Rana clamitans* varying in stage from a few weeks past metamorphosis to full-grown. Twenty-two amputations were made between elbow and wrist or through the hand. All frogs were kept in water. Experimental animals were bathed in saturated sodium chloride solution twice daily for several minutes. The treatments continued for from 1 to 8 weeks with different animals. Fifteen control animals were not treated with salt.

The effects of the treatment were quite pronounced. The stump reddened, the color persisting for several hours, in some cases until the next treatment. The wounds of some of the animals bled during

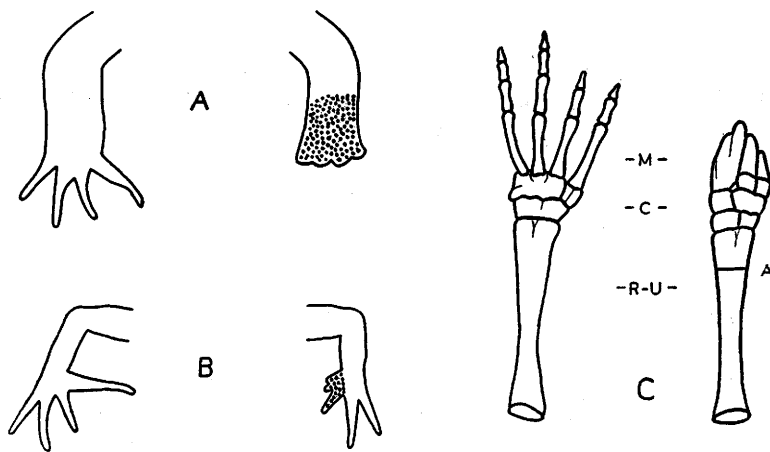


FIG. 1.

Comparison of Salt-induced Regenerants and Normal Limbs.

A—Regenerant stippled. Amputation 7 months earlier when frog was a year past metamorphosis. Treated for 8 weeks.

B—Amputation 4 months earlier when frog was 1 month past metamorphosis. Treated for 3 weeks.

C—Skeletons of regenerant and normal arm compared. A, level of amputation. Regenerated skeletal elements: R-U, part of radio-ulna; C, carpals; M, metacarpals.

⁴ Polejaiev, L. W., *Arch. d'Anat. Micr.*, 1936, **32**, 437.

⁵ Rose, S. M., and Rose, F. C., *Physiol. Zool.*, 1941, **14**, 328.

⁶ Schaxel, J., *Auffassungen und Erscheinungen der Regeneration*, Berlin, 1921.

the salt treatments of the first 2 days; all remained open longer than those of the controls.

Of the 22 experimental animals, only one failed to regenerate. None of the limbs of the 15 controls developed past the stage of a healed stump. The blastema on the limbs of the frogs whose arms were removed below the elbow began as a single mound of soft tissue. The single mound grew and differentiated into a wedge of tissue with the thin edge at the distal border. As growth proceeded a cleft converted the wedge into a double structure distally. Some of the regenerants developed further with new clefts appearing in each of the distal protuberances. By this time it was apparent that the resulting 4 protuberances were finger buds. Fig. 1 A shows such a regenerant. Alongside the regenerant is shown the corresponding limb of the other side. This animal was 5.2 cm long at the time of limb amputation in July and had metamorphosed the previous year or earlier. Fig. 1 B shows finger regeneration following amputation of two fingers from a first year frog. The regenerated first finger appears to be double and the second finger normal. Fig. 1 C shows the regenerated skeletal elements in a frog whose arm had been amputated through the radio-ulna. A movable wrist and imperfect hand regenerated. Skeletal elements along with other internal structures of the regenerants will be described elsewhere.

Adult frog limbs, therefore, regenerate when the wound is kept irritated with a strong salt solution.

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Nitrogen Content and Total Osmotic Activity of Gastric Juice.*

NATHAN LIFSON, RICHARD L. VARCO AND M. B. VISSCHER.

From the Department of Physiology, University of Minnesota.

In a previous communication¹ we reported the degree of hypo- or hypertonicity of gastric juice samples collected from chronic greater curvature (Heidenhain) and pyloric pouches in dogs. Histamine stimulated juices were 2-6 m.E./K hypertonic; pilocarpine stimulated juices were either iso- or hypotonic; and fasting juices were hyper-

* We are indebted to Mr. Charles Carr for carrying out many of the chemical determinations for this study.

¹ Lifson, Nathan, Varco, Richard L., and Visseher, M. B., *PROC. SOC. EXP. BIOL. AND MED.*, 1941, **47**, 422.