in the forehead. It showed extreme trismus, opisthotonos and (tonic) tetanus of all four extremities. The second picture was taken after the dog received intravenously a quantity of magnesium sulphate. The mouth was open, no opisthotonos, and the legs fairly relaxed. The third picture shows the same dog after it received a further quantity of magnesium sulphate. All tetanic signs were clearly abolished and the dog was lying on the back and looked well relaxed. In the fourth picture the dog was photographed on the floor. It was lying on the abdomen comfortably relaxed, the lower jaw slightly hanging down, but the head raised and in a normal position. Fifteen minutes later the dog was walking around in the laboratory without much stiffness.

The demonstration shows, first, that magnesium sulphate administered carefully intravenously in 6 per cent. solution is capable of abolishing all tetanic symptoms and, second, that the relaxing effect is not of a curare-like nature.

130 (1308)

Does the thymus gland of mammals when given as food to amphibians exert any specific influence upon the organism?

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1. When thymus is fed to salamander larvæ, this gland does not exert any specific growth-promoting influence.

This is best shown in the curves obtained from the average sizes ot four series of *A. tigrinum*. Two of the series were kept in high temperature and two in low temperature and in each temperature one series was fed on thymus and one on normal food (mainly earthworms). The thymus diet did not accelerate growth. (The same fact is shown with the aid of pictures.)

Why other writers have reported faster growth in thymus-fed amphibians will be demonstrated by curves obtained from the average sizes of four series of *A. opacum* (*A*, *B*, *C*, *D*, 1916). In all four series, the food was given in pieces of approximately the same size and exactly the same quantity. Since a piece of earthworm contains a great deal of indigestible matter, *i. e.*, soil, cuti-

cule, etc., the worm-fed animals actually received less food than the thymus-fed animals. Therefore, the thymus-fed series grew more rapidly than the worm-fed series. Had we not recorded the number of pieces which were fed to each series, we would have been led to the erroneous conclusion that thymus promotes growth in a specific way.

That thymus does not promote growth in a specific way is also seen from the two following curves obtained from two series (*A*, *B*, 1917) of *A. opacum*. Again in both series the food was given in pieces on a forceps; but to each animal food was given every day, until it would take no more food. Here the worm-fed animals grew even more rapidly than the thymus-fed series.

When the differences in the quantity of food become still greater, the animals show differences in size which are far greater than any reported due to thymus feeding. This is demonstrated by three curves obtained from the average sizes of three series of *A. opacum* (*C*, *D*, *E*, 1917).

These experiments show clearly that the quantity of food had a greater influence upon the growth of the salamander larvæ than the quality of food; amphibians in general react more promptly to small quantitative food differences than warm-blooded animals. Extensive experience with amphibians shows that out of a set of larvæ, certain individuals may take an exceedingly small amount of food, while in other sets, several animals take surprisingly large quantities of food from the very beginning. Differences in size like those produced artificially in the above series may, then, arise by spontaneous and uncontrolled action of the animals themselves and create the impression that a certain kind of food used in a certain experiment caused the difference.

2. Concerning development and metamorphosis, different species of even the same genus seem to react quite differently to the thymus.

In *A. tigrinum*, the thymus feeding produced neither acceleration nor retardation of metamorphosis, if we do not include, for the present, one animal to be mentioned later on. This is indicated in the curves *R*, *S*, *T*, *U*, 1917, and in six pictures.

In *A. opacum* the thymus diet caused a decided acceleration of the development of the gills and the skin (demonstrated by

pictures) and metamorphosis started earlier in the thymus-fed sets than in the worm-fed series. Yet as seen from the curves, the thymus-fed animals also grew more rapidly than the worm-fed animals. Still when they metamorphosed, they were smaller than the worm-fed animals at the time of metamorphosis. It is only recently that I have felt the necessity of knowing more about the relation between metamorphosis and growth in amphibians, and only when our experiments on this point are completed will it be known definitely whether or not the thymus feeding actually does accelerate metamorphosis in salamanders.

The experiments just mentioned are also confusing on account of the fact that only part of the thymus-fed animals actually metamorphosed earlier than the worm-fed animals. In each series of the *Opacum* group there were several individuals which, after they had arrived at the stage preceding metamorphosis, suddenly stopped their development and either died or metamorphosed only after a certain period had elapsed.

In the *A. tigrinum* set there is one thymus-fed animal, which did not metamorphose when the others did. It is still a larva—10 weeks after the rest of the series metamorphosed.

In a thymus-fed series of *A. punctatum*, two individuals remained as larvæ for almost 15 months; and died upon commencing to metamorphose.

It is important to note that "long time" larvæ occurred mostly in thymus-fed series which were kept in low temperatures.

One cannot, of course, but recognize the important bearing on the problem in question, of these "long-time" larvæ, and an examination of them will be necessary. Yet it does not seem that the phenomenon has anything to do with the thymus; for entirely similar cases are encountered in normally kept animals. We had, for instance, one worm-fed animal among a series of *A. punctatum* kept in a cool temperature, which was still a larva 8 months after hatching and then unfortunately was killed by an unsuccessful operation. In another series of only 4 *A. punctatum* larvæ, kept in high temperature, there was one individual which grew normally but did not show any signs of development on its skin throughout its life; it remained larval when the other animals metamorphosed and died as a larva one month later.

3. Finally, attention may be called to an action of the thymus gland which was as yet unknown. Exclusive thymus diet produces in *A. opacum* and *A. punctatum* severe attacks of convulsions, similar to those reported in mammals after extirpation of the parathyroids and known as tetany. Larvæ of *A. opacum* are demonstrated in the state of an acute attack.

No definite idea about the relation between the thymus gland and these convulsions could be formed as yet; perhaps the most interesting characteristic of the phenomenon is that it always seems to start when the animals reach a certain stage of development, and the acute attacks cease when the animals are ready for metamorphosis. Metamorphosed animals of about 18 months which have been fed from the fourteenth day after birth exclusively on thymus, are shown; the animals do not exhibit any signs of convulsions.

From this it is certain that the thymus contains a substance which produces convulsions; whether or not it becomes effective seems to depend on certain organs which disappear or develop in the course of the development of the organism. In fact, there are some indications that the parathyroids are involved in this process: for, first, convulsions are not produced by thymus feeding in the frog and toad larvæ, which develop the parathyroids in a very early stage; and second, the acute convulsions in the *A. opacum* and *punctatum* larvæ cease approximately at the time when the parathyroids develop.

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Demonstration of blood from an extreme case of lipemia in diabetes mellitus.

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The blood of a very severe case of diabetes was demonstrated; it contained 2.14 per cent. cholesterol and a total fat content of 14.4 per cent.