tinal peristalsis under physiological conditions do not produce this effect; that the discharge of material from the gall bladder is even at times initiated against the antagonism of a closed common-duct sphincter and that the usual extensive emptying of the gall bladder proceeds normally in the cat with all of the hepatic ducts tied, far beyond any extent that could be explained on the basis of elastic recoil. The conclusion seems unescapable that the expulsion of its contents in response to fat feeding is a vital function inherent in the gall bladder musculature and independent of extrinsic and mechanical factors.

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Effect of Thyroxin on Growth Rate and Carbon Dioxide Production of Chick Embryo.

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The data presented here represent the attempt at studies made to analyze the influence of thyroxin upon the pre-natal development of the chick. The technique employed was the same as previously described by the writer[1] for injecting substances into the air sac of the incubating hen's egg. The thyroxin was dissolved in dilutions of sterile distilled water just alkaline (NaOH) to litmus so that the required dose was contained in 0.25 cc. The controls were injected with the same amount of alkaline water.

Experiments were made to determine the appropriate dosage that would be within physiological limits. It is necessary to explain that before the sixth and eighth days of incubation the albumen lies between the air sac and the developing chorio-allantois. Thus an injection placed in the air sac previous to this age would be diluted by its absorption into the albumen. A test dose of 1/300 mg. of thyroxin was given before the start of incubation. This dose proved toxic, so the experiment was repeated giving 1/600 mg. before in-

cubation, and repeating the dose on the thirteenth day. None of the chicks hatched. Then the experiment was again repeated giving only 1/600 mg. on the fourth day with the result that 17 hatched out of 24 incubated eggs. These results indicated that the dose of thyroxin injected into the albumen to be below toxicity must not be over 1/600 mg.

By the sixth or eighth day the albumen is crowded toward the vegetative pole and the respiratory vascular network of the chorio-allantois comes into direct contact with the air sac membrane. From this time until hatching absorption takes place directly into the blood stream. Advantage was taken of this in other experiments and results showed that at this time, the maximum dose compatible with hatchibility is in the neighborhood of 1/40,000 mg. of thyroxin.

The next endeavor was to test the influence of thyroxin upon the growth rate. In order to secure slow absorption and maximum effect 1/600 mg. was injected on the fifth day of incubation. The results are recorded in Table I. Each weight is the average of at least 5 embryos. The mortality was high in the thyroxin series but there is apparently no effect on growth rate. Macroscopic examination of those that died revealed no variation from the normal in size or development. This is significant in view of the results obtained by Willier[2] for thyroid grafts upon the chorio-allantois of the

TABLE I.

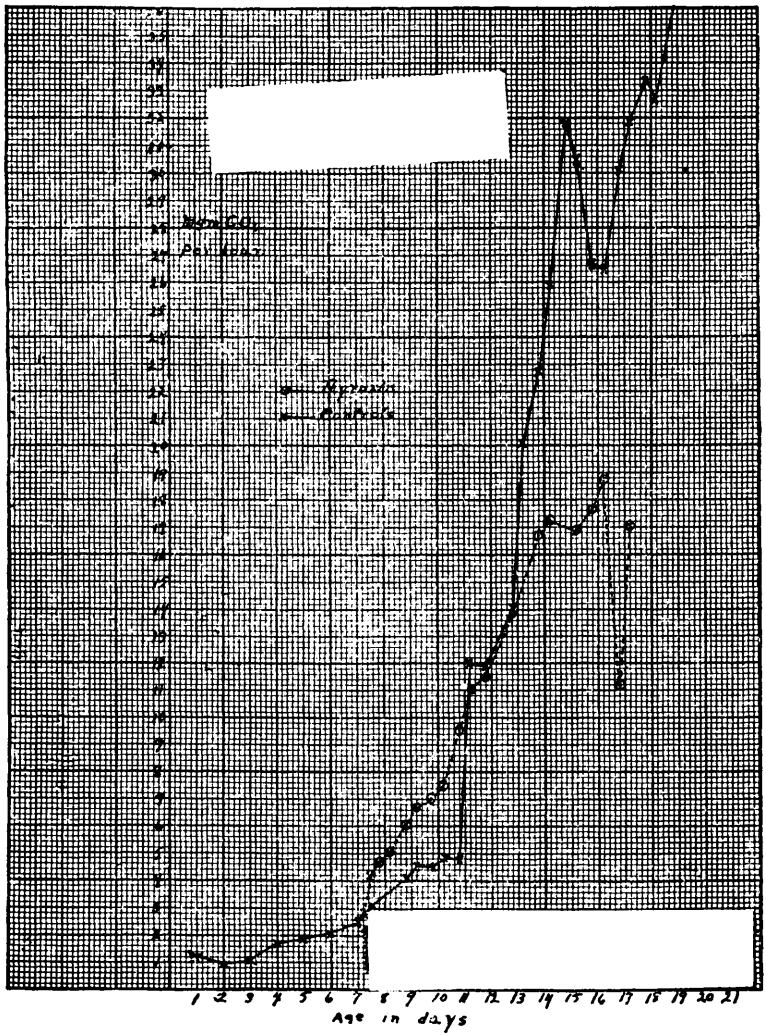
Effect of thyroxin on rate of growth of chick embryo.

Age days	No.	Avg. thyroxin wt.		Avg. control wt.		Mortality	
		Wet	Dry	Wet	Dry	Thyroxin	Controls
5	5	.0397			.00306		
6	5	.16348	.01204	.1205	.00818		1
7	5	.4135	.02602	.3516	.0212	8	3
8	5			.71074	.0456	10	2
9	5	1.0094	.06802	1.03564	.06934	5	2
10						2	1
11	5	2.5573	.18982	2.1935	.16152	2	1
12	5			3.2971	.25502	1	
13	5	5.0178	.4285	5.13708	.4579		1
14				7.22766	.71312	1	
15	5	9.5185	1.48384	9.8966	1.1846		
16							
17	5	16.3158	2.6908	15.5040	2.63804		
18							
19	5	24.3276	4.5119	23.2231	4.4963		
20	5	28.640	5.440	28.120	5.240		
	8	30.2		29.9 forty-eight hours after hatching			

1/600 mg. of thyroxin in 0.25 cc. of distilled water just alkaline to litmus injected into air sac on the 5th day of incubation. Controls injected with 0.25 cc. alkaline distilled water. Average weight of 5 embryos in each series.

chick. He found that the host was always smaller, in some cases one-third smaller, than control.

The CO_2 production was determined by means of an open circuit apparatus using soda lime absorption tubes, similar in principle to the one described by Murray.[3] The average results from 2 typical experiments are shown in Graph 1. The tests in the 2 experiments



GRAPH 1.

Effect of thyroxin upon elimination of CO_2 by the chick embryo. 1/30,000 to 1/40,000 mg. thyroxin in 0.25 cc. alkaline water injected into the air sac on the eighth day of incubation. The controls were injected with the same amount of alkaline water.

varied not over 30 minutes from the same age hour of incubation. The temperature varied between 37°-39° C. Inspection of the control CO_2 curve in Graph 1, which does not vary from the normal, shows that the most easily detected increase above the normal CO_2 production would probably occur between the eighth and twelfth days of incubation. In order to obtain the maximum effect a dose bordering on toxicity (1/30,000 to 1/40,000 mg.) was given just after the control determination of CO_2. As shown, there resulted an increase in CO_2 production extending over a period of about 3 days, then the rate decreased, to remain about the same for 4 days, both embryos dying between the seventeenth and eighteenth days. One of the controls failed to hatch but the CO_2 production remained normal up to the twentieth day. One experiment was carried out using 1/200,000 mg. of thyroxin. The chick hatched but the CO_2 curve did not vary from the normal.

In conclusion, the results showed clearly that when 1/40,000 mg. of thyroxin is introduced into the air sac of the hen's egg at the eighth day of incubation there is a distinct increase in CO_2 production extending over a period of about 3 days. This is followed by a period of marked depression below normal, lasting about 8 days. Doses as small as 1/200,000 mg. produce no demonstrable effect on viability or metabolism. Larger doses (1/30,000 mg. or more) of thyroxin are generally fatal when injected into the air sac at the sixth or eighth day of incubation. A considerably larger amount (1/600 mg.) is tolerated when diluted (possibly modified) by injection or absorption into the albumen at an earlier stage of development, but the period of incubation is not appreciably modified and the weight accretion curve is not altered.

It is proposed to carry out experiments along the same lines with desiccated thyroid gland.

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