

**ON THE PRESENCE OF ACTIVE PRINCIPLES IN THE  
THYROID AND SUPRARENAL GLANDS BEFORE AND  
AFTER BIRTH.**

(SECOND PAPER.)

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(Received for publication, May 6, 1912.)

In the first paper on this subject it was shown that both the thyroid and suprarenal glands from beef, hog and sheep contain their active principles not only at time of birth of the animal but also in the fetus. In the first series of experiments no distinction was made as to the sex of the fetus nor was the relation between the glands of the pregnant animals and those of the corresponding fetuses considered. Another important factor which has not been taken into consideration is the relative activity of the ductless glands of the fetus and of the corresponding digestive glands. As far as the available material permitted, these problems are discussed in the present paper.

With reference to the age and sex of the fetus two important questions naturally suggest themselves, namely, how soon after conception do the glands of the fetus contain active principles, and does the content of active principles in these glands bear any relation to the sex of the fetus? In trying to answer these questions the following set of experiments was made. The work was limited to glands from cattle, as the fetuses of sheep and hogs were too small for practical purposes.

Three stages of age were selected, namely, the fetus six to twelve weeks old; the fetus four to five months old; and suckling calves six weeks old. The glands from the different sexes of the animals were prepared for analysis by trimming and weighing, mincing, drying at 35° to 50°C. to constant weight, and freeing from fat

by extracting with petroleum ether in the Soxhlet's extractor. All the determinations were made in duplicate on composite samples of glands from the number of fetuses and young animals specified in the tabulation below. The thyroid as well as the suprarenal glands were obtained from the same animal in all instances.

TABLE 1.

	FETUS, SIX TO TWELVE WEEKS OLD		FETUS, FOUR TO FIVE MONTHS OLD		SUCKLING CALVES, SIX WEEKS OLD	
	Male	Female	Male	Female	Male	Female
Number of fetuses.....	20	20	6	9	17	23
Average weight of fetuses, grams.....	623	626	5320	5348		
Average weight of thyroid glands, grams .	0.22	0.29	1.90	2.60	8.20	8.00
Average weight of suprarenal glands, grams.	0.07	0.08	0.36	0.40	1.70	1.80
Iodine in desiccated fat-free thyroids, per cent.....	0.07	0.08	0.31	0.20	0.21	0.25
Epinephrin in desiccated fat-free suprarenals, per cent.	3.20	3.40	3.80	4.20	2.60	3.00

The above figures show definitely that both the thyroid and the suprarenals of the fetus contain active principles within a few weeks after conception. Also, the epinephrin in the suprarenals seems to be present in larger and more uniform proportions than the iodine in the thyroids. The amount of iodine in the thyroids does not seem to have any definite relation to the difference in sex, whereas the quantities of epinephrin in the suprarenals seem to be slightly higher throughout in the female than in the male gland. It will, however, require more extended investigations to decide whether these observations will hold good throughout, or are purely accidental.

In order to ascertain if the thyroids from sheep and hogs are normally enlarged and the secretions increased during pregnancy, and whether any definite relationship exists between the amount of iodine in the glands of the pregnant animals and those of the corresponding fetuses, the following series of experiments was conducted on glands from pregnant hogs and sheep and the corresponding fetuses. Four sets of analyses were made at intervals of a week, two on sheep glands and two on hog glands. This precaution was taken to insure variation in sources of the stock and to eliminate possible influences of local conditions upon the animals coming from the same locality. The glands were prepared for analysis as described before.

TABLE 2.  
*Sheep thyroids.*

	FETUS, TWO TO FOUR MONTHS OLD		FETUS, THREE TO FOUR AND A HALF MONTHS OLD	
	Ewe	Fetus	Ewe	Fetus
Number of glands.....	10	17	8	8
Maximum weight per gland, <i>grams</i>	16.8	1.3	8.7	2.3
Minimum weight per gland, <i>grams</i>	3.4	0.4	1.8	1.1
Average weight per gland, <i>grams</i> ...	6.6	0.8	4.7	1.7
Moisture, <i>per cent.</i> .....	71.5	80.0	60.8	82.7
Soluble in petroleum ether, <i>per cent</i>	1.6	0.7	6.0	0.8
Desiccated fat-free gland, <i>per cent.</i>	26.9	19.3	33.2	16.5
Iodine in desiccated fat-free gland, <i>per cent.</i> .....	0.53	0.36	0.28	0.09

TABLE 3.  
*Hog thyroids.*

	FETUS, THREE MONTHS OLD		FETUS, THREE MONTHS OLD	
	Sow	Fetus	Sow	Fetus
Number of glands.....	1	10	4	30
Maximum weight per gland, <i>grams</i>	11.1	0.34	13.0	0.30
Minimum weight per gland, <i>grams</i>	11.1	0.27	6.0	0.15
Average weight per gland, <i>grams</i> ...	11.1	0.30	9.5	0.21
Moisture, <i>per cent.</i> .....	64.0	85.7	67.4	81.3
Soluble in petroleum ether, <i>per cent</i>	15.2	1.0	8.7	1.5
Desiccated fat-free gland, <i>per cent.</i> ..	20.8	13.3	23.9	17.2
Iodine in desiccated fat-free gland, <i>per cent.</i> .....	0.24	0.11	0.45	0.32

The results obtained above show decided individual variations in the amount of iodine present in the thyroid gland of the hog and sheep. They also indicate a definite tendency in the relation between the amount of iodine in the glands of the pregnant animals and those of the corresponding fetuses. The thyroid gland during pregnancy of the hog and sheep does not show any material increase in weight or size. The moisture content, however, is somewhat lower, and the amount of iodine, in at least some instances, higher than in the normal glands of full-grown, non-pregnant hogs and sheep.

So far the writer has dealt with the ductless glands exclusively, and while it has been proven satisfactorily that in the fetus, at least, the thyroid and suprarenals, contain their active principles long before the time of birth, the possibility still suggested itself that a similar condition might exist in the digestive glands.

The digestive glands are not active in the fetus, at least they do not exercise the same function before birth as they do after, and if we, therefore, should find the same active principles in them before birth, we might reason by analogy that the presence of active principle in a gland does not necessarily mean activity on the part of the gland. If this should be the case it would conflict with the idea expressed by the writer that the amounts of active principle present in the thyroid and suprarenals are indications of the relative activity and that since the secretions of these glands are necessary, not merely for the maintenance of life and healthy metabolism, but also to govern the growth of the young animal, we might reasonably expect to find these glands active, not merely at the time of birth, but also in the fetus, especially as these glands only produce internal secretions, which as far as we know, do not enter the alimentary tract.<sup>1</sup>

Of the digestive glands the hog pancreas was found most suitable for investigation, partly on account of the size, and also because the methods for the assay of the diastatic ferment are, in practice, best known as applied to the product obtained from the hog. The pancreas from full-grown hogs as well as from the fetuses were collected simultaneously with the thyroid glands.

The U. S. Pharmacopoeia (1905) test for diastatic power of pancreatin was applied both to the desiccated fat-free pancreas of the hogs and the fetuses. It was found that while the pancreas from the full-grown animals showed a diastatic power of 1:40 in five minutes, the pancreas from the fetuses showed a diastatic power of only 1:2.5 in one hundred and twenty minutes, or a mere trace. Desiccated pancreas testing 1:40 in five minutes in diastatic power will test approximately 1:350 in one hundred and twenty minutes. In this instance, therefore, the pancreas from the full-grown hogs showed a diastatic power approximately one hundred and forty times higher than the pancreas from the fetuses, while the thyroids from pregnant hogs contained only from one-half to one-third more iodine than the corresponding fetuses.

When these facts are taken into consideration, and when it is borne in mind that hepatic and renal activities are established at an early date during intra-uterine life, it seems reasonable by analogy to assume that both the thyroid and suprarenals of the fetus take a distinct and active part in the growth and development of the unborn animal.