

SEE p. 718 - need to convert % of dose/gm  
to rads per some arbitrary ingested dose  
by mother.

## THE COLLECTION OF RADIOACTIVE IODINE BY THE HUMAN FETAL THYROID\*

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THE age at which the human fetal thyroid begins to function has been a matter of speculation for many years. Certain approximate time relations in regard to function have been assigned on the basis of studies such as Gorbman's (1, 2) of the lower forms of animal life. In 1836 Jones (3) was perhaps the first to describe the microscopic structure of the human fetal thyroid. He found that the thyroid was beginning to form differentiated tissue in a fetus of  $4\frac{1}{2}$  months. Both Horcicka (4) and Podack (5) late in the nineteenth century observed that typical glandular structure did not appear until the fifth fetal month.

In Cooper's (6) study of the human thyroid at various ages of intra-uterine growth, she observed the beginning of follicle formation by the thirteenth week, but no colloid or secretion within the lumina until late in the fourth month of pregnancy. The more differentiated tissue containing colloid seemed to appear at the periphery of the thyroid. Observations by Norris (7) indicated that typical colloid does not appear until the embryo measures 60 mm. (C-R), or is approximately 12 to 13 weeks old.

We are not aware, however, of definitive studies of this problem in human physiology. It occurred to us that the earliest age at which collection of radioactive iodine by the human fetal thyroid could be observed would be an indicator of the age of onset of thyroid function.

### METHODS

A cooperative investigation was planned with the pathologists at the Boston Lying-in Hospital and the physicists at the Massachusetts Institute of Technology. Pregnant women with organic disease that endangered their health, were given tracer doses of radioactive iodine from twelve to forty-eight hours before operation. The urinary excretion of radioactivity was measured. At operation the intact fetus was obtained and carefully measured for the approximation of age in weeks. The fetus was then fixed

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TABLE 1. COLLECTION OF RADIOACTIVE IODINE BY THYROIDS OF FETUSES RANGING IN AGE FROM 7 TO 32 WEEKS

Fetus No.	Per cent maternal urinary excretion of I <sup>131</sup>		Fetal length (millimeters)	Age in weeks	Sex	Histology of the thyroid	Collection of radioactive iodine by the thyroid
	Hrs.	%					
1	0-24 24-48	58 7	19	7		Undifferentiated	0
2	0-24 24-48	28 —	52	11		Undifferentiated	0
3	0-24 24-48	61 1	55	11.5	Male	Undifferentiated	0
4	0-24 24-48		55	11.5	Male	Undifferentiated	0
5	0-24 24-48	55 1	58	12	Male	Undifferentiated	0
6	0-24 24-48	59 3	95	14.5	Male	Undifferentiated	0.08%/Gm.
7	0-24 24-48	56 1	110	16	Male	*Follicles	0.12%/Gm.
8	0-24 24-48	18 3	170	20	Male	Follicles	0.11%/Gm.
9	0-24 24-48	56 6	280	32	Male	Follicles	4.83%/Gm.

\* Photomicrograph (see Fig. 1).

in formalin and sectioned longitudinally through the midline. Tissues from one half were prepared for microscopic section, while those from the other half were macerated in 5 per cent potassium hydroxide for Geiger counts of radioactivity.

Tissues to be macerated were obtained from three levels: first, from the upper pharynx down to the upper thorax; second, from the upper thorax to the upper abdomen; and third, from the upper to the lower abdomen.

ALREADY, BY NATURE OF THE STUDY, TAKES INTO ACCOUNT PLACENTAL CONCENTRATING FACTORS & TIME AT LEAST TO 48 HOURS.

Histologic study of the tissue harboring radioactivity was thus possible by what our Canadian cousins might designate a study of "opposite numbers." Radioautographs were not attempted.

#### RESULTS

Tissues from 9 fetuses ranging in age from 7 to 32 weeks have been studied in the manner described (Table 1). In those aged 7 to 12 weeks the tissue containing thyroid did not exhibit radioactivity. In those aged from



Fig. 1. Section of thyroid from fetus no. 7, aged 16 weeks (Table 1), showing follicle formation with colloid and minimal collection of radioactive iodine.

14 to 32 weeks, the thyroid showed an amount of radioactivity that seemed to increase with succeeding ages in weeks. Other tissues did not contain appreciable amounts of radioactivity, so it seems that iodine has its selective affinity for the thyroid even at this early age.

Histologic studies of the fetal thyroid confirm the previous opinion that the onset of function as measured in this manner is associated with the appearance of definite follicles containing colloid (Fig. 1).

## SUMMARY AND CONCLUSIONS

Our studies indicate that the human fetal thyroid does not collect administered radioactive iodine in the first twelve weeks of life and that increasing amounts of radioactive iodine are collected after the fourteenth week. If we assume that radioactive iodine collection and functional activity are synonymous, then by this method we have approximated the age of onset of physiologic activity of the human fetal thyroid.

A practical application of this knowledge lies in the use of radioactive iodine in the treatment of toxic goiter. Women up to the fourth month of pregnancy may be given therapeutic doses of radioactive iodine without retention of such radioactivity by the fetus. Actually, to date, we have treated one woman in the second month and another in the sixth month of pregnancy. Their children are now aged 14 and 18 months respectively and appear healthy and show no signs of myxedema.

## ACKNOWLEDGMENT

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