strength are used. We found that these eluting conditions prevent break-through of serum gamma globulins. Like human anti-A, anti-B, and anti-D(7), phytohemagglutinin is heterogeneous under these chromatographic conditions. In fractions exhibiting activity, agglutination was observed with each test rbc. When titrated *vs.* the rbc panel, crude bean extract and fractions from the 3 activity peaks gave the same titers with each rbc used. Thus, despite fractionation of hemagglutinating activity, it appears that panagglutinin character is preserved qualitatively and quantitatively in each segment of the chromatogram.

*Summary.* A crude preparation of McCaslan Pole Bean phytohemagglutinin has been fractionated chromatographically on DEAE-cellulose. Hemagglutinating activity, followed by testing each fraction with an rbc panel, was found in 3 groups of fractions. In each of these groups the activity was panagglutinating and gave the same titers with each rbc used in testing.

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## Effect of Growth Hormone Upon Thyroid Secretion Rate in the Rat.* (24527)

CLARK E. GROSVENOR† AND CHARLES W. TURNER
*Department of Dairy Husbandry, University of Missouri, Columbia*

It has been shown that thyroid hormone output increases during growth(1) and lactation(2) in the rat. Growth hormone (GH), in addition to its well known ability to cause an increase in body weight(3), has been demonstrated to cause an increase in milk secretion in this species(4). It seemed of interest, therefore, to determine if these effects of GH were associated with an alteration in thyroid activity.

*Materials and methods.* Adult virgin female rats of Sprague-Dawley-Rolfsmeyer strain weighing 240-300 g were kept under conditions of uniform temperature (78 ± 1° F) in room artificially illuminated during normal daylight hours for 5-6 weeks prior to experiments. Some were bred with male rats of same strain during this time. Each of 29 litters obtained was reduced to 6 young shortly after birth and, on 4th day postpartum, each mother was injected i.p. with 2 $\mu$c carrier-free $I^{131}$. Thirty-five non-lactating rats were similarly injected. Forty-eight hours were allowed for fixation of $I^{131}$ by the thyroid and for urinary elimination of excess isotope. External thyroid counts were taken at this time and at either 24 or 48 hour intervals thereafter by first anaesthetizing each animal with ether, then placing it on a lead plate with its thyroid region over a scintillation probe. Measurements of thyroidal radioactivity were made with scintillation counter, Nuclear-Chicago (N.C. Model DS 5) connected to pulse height analyzer (N.C. Model 1810) which, in turn, was connected to a rate meter (N.C. Model 1620A). Conventional corrections were made for radioactive decay and background. *Measurement of thyroid secretion rate (TSR).* Twenty-four lactating and 15 non-lactating rats were injected subc.

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† Postdoctoral Fellow of N.I.H. This investigation was supported in part by grants from P.H.S.

with GH‡ at 1 mg/day commencing 3 days after injection of $I^{131}$ (7th day postpartum for lactating animals). The non-lactating rats were injected subc. with L-thyroxine at .5 μg/100g/day for 2 consecutive days starting 4 days after $I^{131}$. The dose was increased at .5 μg/100g increments, each level for 2 consecutive days with thyroid count taken the day of each increase. Each lactating rat was similarly treated with the exception that initial dose of L-thyroxine was either .5 or 1.0 μg/100 g and the dose increased at 1 μg/100 g increments. TSR was determined by plotting percentage of previous count with thyroxine dose. The dose which prevented further thyroidal $I^{131}$ output in each rat (95-100% of previous count) was estimated as its TSR. In lactating rats, extrapolation to 100% of previous count was necessary when TSR was not obtained by day 16 postpartum. Average TSR of each group was compared with control values previously obtained with the same strain of rats under identical conditions(2). *Effect of GH upon rate of release of thyroidal $I^{131}$.* Twenty non-lactating and 5 lactating rats were injected daily 8 days commencing 48 hours after $I^{131}$ injection with levels of L-thyroxine (3 and 3.5 μg/100 g for non-lactating and lactating rats, respectively) which exceeded by .5 μg/100 g in each case the highest TSR previously observed(2). External thyroid counts were made every 24 hours during this period, the last count obtained 24 hours after last injection. The animals were treated subseqeuntly as follows: 1) Five non-lactating rats received only L-thyroxine; 2) Five non-lactating and 5 lactating rats were injected with 1 mg/day GH for 4 days starting the 4th day of thyroxine treatment; 3) Since each mg of GH contained approximately .008 USP thyrotropin (TSH), 5 non-lactating were injected with this level and 5 with .024 USP TSH§/day for 4 days starting 4th day of thyroxine treatment. Rates of thyroidal $I^{131}$ release during each 4 day control and experimental period were based upon the calculated slope of each regression line. Significance of difference between control and experimental slopes in each group was estimated by the method of analysis of variance.

TABLE I. Effect of GH upon Thyroid Secretion Rate in Rats.

| Treatment | No. of rats | Avg Body wt (g) | Avg TSR (μg/100 g L-thyroxine) |
|---|---|---|---|
| Non-lactating control* | 20 | 262.0 | 1.3 ± .11 |
| *Idem* + 1 mg GH/day | 15 | 245.4 | 1.2 ± .13 |
| Lactating control* | 16 | 285.3 | 2.2 ± .22[1] |
| *Idem* + 1 mg GH/day | 24 | 285.3 | 2.9 ± .12[2] |

* Data from Grosvenor and Turner(2).

| Student's "t" 1–2 | Probability .01 |
|---|---|

*Results.* Body weight of non-lactating and lactating rats injected with 1 mg GH/day increased 2 g/day in comparison with no gain for control non-lactating and .5 g/day for lactating rats during the same interval. Average TSR of non-lactating rats injected with GH was not significantly altered from the control value of 1.3 μg/100 g L-thyroxine (Table I). During days 8-16 postpartum, the average TSR of 2.9 μg/100 g for lactating rats receiving GH was 32% greater than the value of 2.2 μg/100 g obtained for untreated lactating rats. The difference was significant ($P = .01$). Thyroidal $I^{131}$ output was almost totally prevented in non-lactating and lactating rats by daily administration of L-thyroxine which exceeded their TSR (Fig. 1). No change in rate of thyroidal $I^{131}$ output of non-lactating rats resulted from subsequent administration of 1 mg GH or from TSH in amounts equal to or 3x greater than that present in 1 mg GH. A significant increase ($P = .01$) in rate of thyroidal $I^{131}$ output occurred, however, in lactating rats injected with 1 mg GH.

*Discussion.* The influence of GH upon thyroid activity has received little attention. It has been shown GH significantly reduced thyroidal uptake of $I^{131}$ and tended to decrease serum $I^{131}$ in adult rats though an increase in body weight occurred(5). In our study, GH evoked gains in body weight on the average

‡ The growth hormone (NIH-BGH-1) is a highly purified bovine preparation distributed by the Nat. Inst. Health.

§ Reference Standard containing .074 USP TSH/mg.

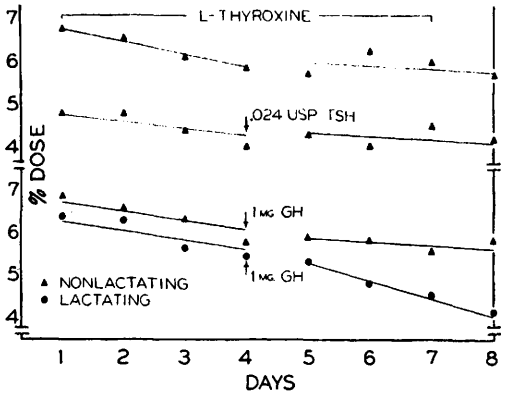


FIG. 1. Effect of GH and TSH upon rate of release of thyroidal $I^{131}$ in rats whose normal thyroid hormone output has been almost totally prevented by daily administration of L-thyroxine in doses (3.0 and 3.5 μg/100 g for non-lactating and lactating rats, respectively) which exceed daily thyroid secretion rate. Each slope represents avg of 5 rats.

of 2 g/day, but failed to alter TSR or increase rate of thyroidal $I^{131}$ release in mature female rats. It would appear that ability of GH to increase body weight does not involve an alteration in thyroid activity though it is well known that thyroid hormones play an important role in the growth process through their control of cellular metabolism.

Increased milk yields have been shown to result from administration of GH to lactating rats(4), cows(6,7), goats(8) and sheep (9) presumably because of favorable influences exerted upon protein, carbohydrate and fat metabolism. In the present investigation significant increases in TSR and rate of thyroidal $I^{131}$ release occurred in lactating rats injected with GH. This suggests that a part of the galactopoietic action of GH in lactating rats may be due to increased levels of thyroid hormones, as a mild hyperthyroidism is generally thought to be desirable for optimal milk secretion(10). This would assign to GH ability to cause an increased secretion and/or release of TSH or thyroxine. There was no indication, however, that these effects were caused by the slight contamination of GH with TSH since the latter in amounts 3x that present in 1 mg of the GH preparation failed to alter release rate of thyroidal $I^{131}$ or affect TSR of non-lactating rats. The data in the present study may be interpreted also as suggesting that elevated thyroid activity is an effect rather than a cause of increased milk secretion due to GH. A concomitant increase in metabolic demands by the mammary gland, imposed by GH, may so increase thyroxine requirements for control of cellular metabolism that the pituitary-thyroid servomechanism may become adjusted to operate at a higher level of activity.

*Summary.* The effect of 1 mg/day GH upon thyroid activity has been studied in non-lactating and lactating rats. GH did not alter thyroid secretion (TSR) or affect rate of release of thyroidal $I^{131}$ in non-lactating rats though body weight was increased 2 g/day. During days 8-16 of lactation, the average TSR of 2.9 μg/100 g L-thyroxine for lactating rats receiving GH was significantly greater than the 2.2 μg/100 g obtained for untreated lactating rats. Rate of release of thyroidal $I^{131}$ also was significantly increased suggesting GH in some manner effects an increase in output of TSH or thyroid hormones in the lactating rat.

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