

Thyroid Hyperplasia in Rats Following Thymus Feeding.

K. KJERULF-JENSEN. (Introduced by H. Dam.)

From the Research Laboratory of Ferrosan Ltd., Copenhagen, Denmark

Hou¹ stated that rats fed on a soybean-millet diet with dried liver powder as the only source of animal protein developed a marked hypertrophy of the thyroid gland.* The thyroid hyperplasia did not seem to be due to administration of the animal protein as such, since rats given dried beef powder instead of liver powder developed only a relatively slight hyperplasia. The goitrogenic principle could be removed from the liver tissue by alcohol extraction. This pronounced goitrogenic effect of dried liver powder in Hou's experiments was so considerable that, according to our experience, feeding with about 0.1 mg 2-thio-4-methyl-uracil per 10 g diet would be required to produce a comparable enlargement of the thyroid gland.

The goitrogenic effect observed in the experiments reported below was not so pronounced as that seen in Hou's experiments. On the other hand, thyroid hyperplasia could be elicited not only by adding dried thymus powder to the soybean-millet diet, but also by giving a usual standard diet with addition of thymus. It was impossible in this case to remove the goitrogenic substance in the thymus tissue by alcohol extraction. Addition of corresponding amounts of dried ox-liver powder to the soybean-millet diet caused very little thyroid hyperplasia in these experiments. Dried beef powder had no goitrogenic effect. The goitrogenic effect of the thymus administered did not seem to be due to the contents of nucleoprotein as such, since no goiter was developed after administration of dried cod spawn in corresponding amounts.

Groups of 5 rats each were given the different diets. (The initial weights of the animals ranged from 60 to 120 g, so that the body weights by the end of the experimental periods

differed but little). The rats were killed after 30, 60, and 90 days respectively, and their thyroids were excised, weighed, and submitted to histological examination. The weights were indicated in percent of the normal, as pointed out in a previous paper by Jensen and Kjerulf-Jensen.²

The diet consisted of the following substances:

Soybean flour	450
Millet	500
Sodium chloride	20
Cod liver oil	1
Ascorbic acid	0.5

This diet was supplemented by

1. Dried thymus of young calves: 30 (1 g dried thymus corresponded to 4.7 g fresh thymus).
2. Residue of dried thymus gland, extracted by 5 vol. of ethyl alcohol at 25°C, in the above amounts.
3. Water-soluble fraction of the alcohol extract of dried thymus in the above amounts, as well as dried beef: 30.
4. Water-insoluble fraction of alcohol extract of dried thymus in the above amounts, as well as dried beef: 30.
5. Dried beef powder: 30.
6. Dried ox liver powder: 30.
7. Alcohol extract of dried ox liver in the above amounts, as well as dried beef: 30.
8. Dried cod spawn: 30.

The histological conditions were indicated as: 0 = normal, or: + = slight, *i.e.* slight cellular hyperplasia with increase in the height of the cells of the glandular epithelium, and inconsiderable reduction of the amount of colloid substance, or: ++, *i.e.* increase in cell height as well as marked reduction of the amount of colloid substance.

Feeding with dried thymus elicited thyroid hyperplasia also in rats given the usual laboratory diet instead of the soybean-millet diet mentioned above. Administration of up to 10 times as much thymus added but little

¹ Hou, C. H., *Proc. Soc. Exp. Biol. and Med.*, 1940, **43**, 753.

* For further references to literature *vide* the quoted article by Hou.

² Jensen, K. A., and Kjerulf-Jensen, K., *Acta pharmacol.*, 1945, **1**, 280.

TABLE I.
Thyroid Hyperplasia of Rats after 1, 2, or 3 Months of Feeding with Soy Bean-Millet Diet
Supplemented by Dried Thymus, Beef, Ox Liver, or Cod Spawn Respectively

Diet No.	Avg size of thyroid in % of norm. for groups 5 rats for 30, 60, and 90 days respectively			Cellular hyperplasia of thyroid, estimated for each individual group as an entirety		
1. Dried thymus	123	130	126	+	++	++
2. Thymus, extr. by alcohol	120	124	136	++	++	++
3. Water soluble fract. of thymus ale. extr.	143	108	130	+	0	+
4. Water insolub. fract. of thymus ale. extr.	99	140	138	0	+	+
5. Dried beef	117	144	124	0	0	0
6. Dried liver	137	116	113	0	0	+
7. Alcohol extr. of ox liver	111	153	123	0	+	+
8. Dried cod spawn	115	106	108	0	0	0

to the increase in the size of the thyroid, whereas the histological changes, *i.e.* the cellular hyperplasia and especially the reduction of colloid substance became particularly pronounced.

Summary. Moderate cellular hyperplasia of the thyroid was produced in rats on a soy-

bean-millet diet or a usual standard diet by adding dried thymus from calves.

The goitrogenic fraction was insoluble in water and ethyl alcohol; no goitrogenic effect was observed after feeding with dried ox liver, dried beef or dried cod spawn.

16177

Isolation and Properties of Raphanin, an Antibacterial Substance from Radish Seed.

G. IVÁNOVICS AND S. HORVÁTH. (Introduced by G. Gomori.)

From the Institute of General Pathology and Bacteriology, University of Szeged, Hungary

Antibacterial substances are not rare in various higher plant species.¹ In the course of a systematic investigation of aqueous extracts of plants belonging to the family of Cruciferae for the presence of antibiotic principles we found² that extracts of the seeds of radish (*Raphanus sativus*), when tested by the cylinder plate method (Heatley³), gave a wide zone of inhibition on plates seeded either with *Staph. aureus* or with *B. coli*. The substance responsible for the action could be purified and finally isolated as a homomolecular liquid.

Experimental. The aqueous extract of the seeds is very effective in preventing the

growth of bacteria. The cell-free extract prepared by the extraction of one part of finely ground seeds with 5 parts of water gave a 30 mm zone of inhibition on plates seeded with *Staph. aureus* or *B. coli*. Even extracts prepared in the ratio of 1:50 caused marked inhibition. The antibacterial principle is fairly resistant to heat; only a slight decrease in potency was observed after heating it to the boiling point for 30 min. The cell-free extract will retain full activity for weeks if stored in the ice box. However, all activity is lost within 24 hours if the extract is incubated with the crushed seeds at 37°C. Considerable inactivation occurs under such conditions even at 20°C; in fact, even at ice box temperature. On the other hand, heating the suspension to 60°C for 15 min. completely prevents inactivation.

¹ Kavanagh, F., *Adv. Enzymology*, 1947, **7**, 461.

² Ivánovics, G., and Horváth, S., *Nature*, 1947, **160**, 297.

³ Heatley, N. G., *Bioch. J.*, 1944, **38**, 61.