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Histological Studies on the Functional Development of the Thyroid Gland of the Chick Embryo.

I. Histochemical Observations.

家鶏甲状腺の機能発生に関する組織学的研究.

I. 組織化学的觀察.

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The functional development of various endocrine organs has been one of the most interesting subjects in embryology. Using the thyroid gland of the chick embryo, following problems were examined: 1. when does the colloid droplet begin to be produced? 2. when does this gland obtain the latent function to produce the colloid droplet? 3. how does the TSH injected affect the early colloid formation of the epithelial cell?

I. Materials and methods.

Materials we used in this study were removed from seventy White-Leghorn chick embryos. We made them into 4 groups: group I serving as control, group II treated with a single injection of 10 or 25 i. u. of the TSH (Pretiron of SHERING) into the yolk sac at 4, 5, 6 or 7 days of incubation, group III with that of 40 μ c of I^{131} 2—12 hours before decapitation and group IV with that of the TSH as group II and simultaneously 40 μ c of I^{131} as group III. These chick embryos were killed by decapitation at on the 6, 7, 8, 9, 10 and 11th day of incubation. The group I and II were fixed in BOUIN's solution, embedded in paraffin, cut at 6 μ and stained with periodic-acid-SCHIFF, azan and hematoxylin-eosin. The group III and IV were fixed in alcohol, embedded in paraffin, cut at 6 μ and autoradiographed by stripping method.

II. Results.

Normal thyroid glands of the 6, 7 and 8 days old chick embryos were mainly made up of the epithelial cords and loose mesenchyme, and no periodic-acid SCHIFF positive colloid droplet was observed. Though KRAICZIZEK reported that the small colloid spots were found in the epithelial cell of the 8 days old chick embryo, we did not recognize any droplet in normal embryos of 8 days old using both light and electron microscopes.

At 9 days of incubation, in one third of the whole cases, we found a number of small spots of 1—2 μ in diameter stained purple by periodic-acid-SCHIFF method.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

distributing throughout the whole epithelial cords, as reported by WOLLMAN and ZWILLING. However, most of 9 day-old embryos lacked of the colloid droplet in this organ. At 10 days of incubation, the droplets were observed in all the cases. They were lying not only between two or a few cells as a simplest colloid follicle, but also in the cytoplasm of a epithelial cell as an intracellular colloid droplet. BRADWAY, YOSHIKAWA, HOPKINS and VENZKE reported that the thyroid colloid droplets appeared at 10—11 days of incubation. But the hematoxylin-eosin staining is not always suitable to show clearly the smallest thyroidal colloid spots in the early stage of their formation.

In the case of a single injection of 10 or 25 i. u. of TSH at 4, 5, 6 or 7 days of incubation, colloid droplets stained purple by periodic-acid-SCHIFF method appeared distinctly in the thyroid epithelial cords in all 8 days old chick embryos. The diameter of these spots was 1—5 μ and as large as those of normal 10 days old embryo. Before 8 days, even if more than 25 i. u. of TSH was injected at any day, we found no periodic-acid-SCHIFF positive droplet in the thyroid gland.

By autoradiography, the I^{131} uptake of the thyroid gland of the 8 days old embryo was distinct, but at 7 days the radioactivity was too slight to be found out.

Fig. 5. Radioautogram. I^{131} uptake of the normal thyroid gland of a 9 days old chick embryo. Forty μ c. of I^{131} was injected into the yolk sac 6 hours before decapitation. $\times 120$.

Fig. 1. A normal thyroid gland of a 8 days old chick embryo. Periodic-acid-SCHIFF method. $\times 500$.

Fig. 2. A normal thyroid gland of a 10 days old chick embryo. Periodic-acid-SCHIFF method. $\times 500$.

Fig. 3. A normal thyroid gland of a 11 days old chick embryo. Periodic-acid-SCHIFF method. $\times 500$.

Fig. 4. A thyroid gland of a 8 days old chick embryo treated with 10 i. u. of TSH at 6 days of incubation. Periodic-acid-SCHIFF method. $\times 500$.

Summary.

1. In the normal chick embryo, the thyroïdal colloid droplets appear at 9—10 days of incubation.
2. The thyroid gland obtains the latent function to make a colloid 8 days after the beginning of incubation, but, in this days old embryo the TSH (thyroid-stimulating hormone) content in the blood stream seems not to be sufficient to stimulate the gland.
3. The TSH injected at 4—7 days of incubation stimulates the gland to produce the colloid droplet at 8 days of incubation.

内 容 自 抄.

白色レグホン種の家鶏孵卵 70 個を用い、4 つのグループに分けた。即ち第 1 のグループはコントロールとし、第 2 のグループには、孵卵満 4, 5, 6, 7 日の何れかの日に一回 TSH (甲状腺刺激ホルモン) (Shering 製プレチロン) 10—25 単位を卵黄嚢に注射し、第 3 のグループには動物を殺す 2—12 時間前に I^{131} 40 μ c を注射し、第 4 のグループには上述の TSH と I^{131} をそれぞれ与えた。これらの胎児は孵卵 6, 7, 8, 9, 10 及び 11 日に断頭し、グループ 1 及び 2 は Bouin 液で固定してパラフィンで包埋し、6 μ 薄切、H-E, azan, PAS 等の染色を行ない、グループ 3 及び 4 はアルコール固定、パラフィン包埋後、ストリッピング法によりオートラジオグラフィーを行なった。

正常の 6, 7, 8 日の孵卵では甲状腺は細胞索の塊をなし、PAS 陽性のコロイドは全く見られない。孵卵 9 日では約 $\frac{1}{3}$ の例に於いて直径 1—2 μ の PAS 陽性の小滴が細胞索の中に散在性に出現する。周辺部、中心部の何れにも同じように現われる。孵卵 4—7 日のどの日かに 1 回 TSH を 10—25 単位注射した場合には孵卵 8 日で全例に、甲状腺細胞索内に直径 1—5 μ の PAS 陽性の小滴が散在性に出現する。但し孵卵 7 日以前には絶対に現われない。

オートラジオグラフィーを行なった場合には、孵卵 8 日から I^{131} の甲状腺集積が陽性を示す。それ以前は何とも断定出来ない。TSH 注射のものでは遙かに大量のヨードが甲状腺に集まる。

まとめると次のようになる。鶏の甲状腺のコロイドは普通満 9—10 日に出現するが、8 日から既にコロイド生産能力を有する。ただ体内の TSH 量が少ないためコロイド出現がしないのであって、TSH を外部から与えると 8 日でコロイドが作られることが分かる。但し 7 日以前には甲状腺はコロイド生産能力を有しない。

References.

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