themselves. Furthermore it appears hardly conceivable that the function of the liver cells in a space of 6 to 8 days after relief of the obstruction could change itself from that of a colorless secretion to normal bile. My theory of the white bile in relation to the clinical observations noted after relief of the common duct obstruction is as follows: First, the decolorization of the stagnant bile in the bile duct is caused by infection. The liver cells produce for a considerable period after obstruction a green bile and this secretion is finally stopped on account of the rise in pressure in the liver or it may flow back into the blood stream. After the relief of the obstruction, the white bile already present in the dilated bile ducts pours out first. The fluid discharged in the first few days one might expect to be the secretion of the bile tract epithelium in which a further recurrent infection has been stirred up by the operation. Finally the liver function itself returns, provided that the liver cells have not been too severely damaged, and true bile appears.

7823 C

Thyroid Hypertrophy in the Rat with Reference to the Effect of Light.*

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In describing the thyroid hypertrophy and colloid loss in rats exposed to cold and darkness for 10 to 25 days the writer[1] noted that he had not seen any striking changes due to darkness alone. Bergfeld[2] had previously stated that in 4 to 6 weeks, absence of ultraviolet light caused thyroid hypertrophy irrespective of the environmental temperature and that in his small series no effects attributable to cold were found if the room were illuminated. While students using the rat have not agreed on this effect of darkness, conclusive evidence that in the chick absence of ultraviolet light for 55 to 105 days results in marked thyroid hypertrophy and colloid loss has been provided by Turner and Benedict.[3] The interesting possibility thus suggested that light may play some vital rôle in

* This study was conducted in part under a grant from the Douglas Smith Foundation for Medical Research.

[1] Kenyon, A. T., *Am. J. Path.*, 1933, **9**, 347.

[2] Bergfeld, W., *Endokrinologie*, 1930, **6**, 269; *Strahlentherapie*, 1931, **39**, 245.

[3] Turner, K. B., and Benedict, E. M., *J. Clin. Invest.*, 1932, **11**, 761.

the formation of the thyroid hormone has led the writer to further examine its possible influence under the conditions of temperature and diet used in his earlier work.

From March 8 to June 13, 1933, (98 days) 10 albino rats of about 90 gm. in weight were kept in a dark room at an average temperature of 26.5°C. and compared with 9 litter-mates of the same sex kept in ordinary room light at 25° and irradiated an average of 40 minutes weekly at 24 inches with an Alpine sun (Mercury vapor) lamp. During the last 75 days of this study 3 rats of about 60 gm. and 6 uncontrolled young, born in the dark, were added to the series. The diet (yellow corn 62; linseed oil meal 13; whole milk powder

TABLES.

Experiment	No. of Animals	Amount of Colloid: 0-1 most	0-1 part	0-1 absent	0-1, 2	2	2, 3	3	3, 4	Height of Epithelium: 3, 4	3	2, 3	2	1, 2	Aver. wt. of thyroid mg. / 100 gm. body wt.
1 a.		March 8 to June 13, 1933								98 days					
Dark at 26.5°	10	3	2	5	0	0	7	0	0	5	2	3	0	0	17.2
Light and irrad. at 25°	9	0	0	9	0	1	6	0	2	0	2	1	4	2	9.8
1 b.		April 1 to June 13, 1933								75 days					
Dark at 26.5°	3	0	0	3	0	0	2	1	0	0	0	0	3	0	11.9
Light and irrad. at 25°	3	0	0	3	0	0	3	0	0	0	0	0	3	0	9.8
Dark at 26.5° (Born in dark)	6	0	0	6	0	0	6	0	0	0	0	2	4	0	17.3
1 c.		January 15 to May 4, 1934								109 days					
Dark at 28.7°	22	1	2	19	1	1	15	4	0	3	5	7	7	0	10.4
Light and irrad. at 25°	20	1	5	14	4	0	14	0	1	5	10	3	2	0	12.4
2		March 21 to April 13, 1934								13 days					
Dark at —3°	16	5	8	3	8	0	3	0	0	10	5	1	0	0	17.0
Dark at —3° and irrad.	16	7	7	2	3	2	4	0	0	9	7	0	0	0	18.0
3 Cold		Aug. 28 to Sept. 8, 1934 (11 days)								Recov. to Sept. 20 (12 days)					
Dark at 29.5°	8	5	3	0	3	0	0	0	0	8	0	0	0	0	23.0
Dark and irrad. at 29.5°	8	2	6	0	4	0	2	0	0	6	2	0	0	0	24.0

Key: The first series of columns under "amount of colloid" designates the occurrence of areas of little or no colloid (0-1) throughout the gland, in parts, or absent. The second series of columns gives the distribution of various grades of follicular colloid content predominating in such glands as have more than traces of colloid; 2 = small follicles filled with colloid; 3 = medium follicles filled with colloid; 4 = large follicles filled with colloid. Such conjoint expressions as 0-1, 2 indicate that both degrees are found in abundance. Under "height of epithelium" 4 indicates high columnar; 3 = low columnar; 2 = cuboidal, and 1 = flat. Conjoint expressions as 3, 4 indicate that both types are present in large numbers.

18; casein 4; alfalfa 2; sodium chloride 0.5; and calcium carbonate 0.5) had an iodine content of 13.5 gamma/100 gm. (second month) and 15.6 gamma/100 gm. (third month). The significance of the colloid loss appearing in half of the group kept 98 days in the dark is unfortunately probably vitiated by the presence of pulmonary and liver infection disclosed at autopsy in both experimental and control animals, but is of interest in indicating that thyroid hypertrophy may occasionally occur in rats under certain circumstances on diets yielding 1.4 gamma of iodine daily. (Table 1 a, 1 b.)

From January 15 to May 5, 1934, (109 days) 22 rats of about 120 gm., and of a mixed strain, free from infection at the end, were kept in the dark at 28.7°C. and compared with 20 litter-mates of the same sex and hood-color kept at 25° and irradiated as before for an average of 27 minutes weekly. The diet had an iodine content of 6.9 gamma/100 gm. No striking hypertrophy and colloid loss occurred generally in the experimental animals although the occasional appearance of such changes, both in the experimental and control series, indicates that the stock as a whole should have been favorable for such a development. Mayerson and Branch[4] have recently reported a careful study in agreement with these findings (Table 1 c).

From March 20 to April 3, 1934, (13 days) 16 of 32 animals kept at —3°C. in the dark, were irradiated at 28° for 10 minutes on each of 8 days. The striking hypertrophy and colloid loss produced by cold are evident in both groups. This is as far as the writer's present physical set-up permits him to go in testing the possibility that ultraviolet light inhibits the changes induced by cold and the results are, within these limits, negative (Table 2).

From August 28 to September 8, 1934, (11 days) 16 animals were exposed to cold and dark and marked hypertrophy produced in all, as judged by biopsy. They were then placed in the dark at 29°C. and half of them irradiated 30 minutes daily for the last 10 days of their 12-day stay. The diet during both cold and warm periods (yellow corn 75; linseed oil meal 15; casein 5; alfalfa 2; brewer's yeast 2; sodium chloride 0.5; calcium carbonate 0.5) contained 8.7 gamma iodine/100 gm. The irradiation did not decisively influence the rate of recovery from the effects of cold (Table 3).

By the twelfth day in a warm room the recovery from the effects of the cold had progressed a little way only, as judged by recession

[4] Mayerson, H. S., and Branch, C. H. H., PROC. SOC. EXP. BIOL. AND MED., 1934, **31**, 650.

of hypertrophy and accumulation of colloid. The intense mitotic proliferation of the biopsy specimens had, however, completely subsided. The diet containing 8.7 gamma per 100 gm. is unable, in the time given, to provide materials with which a substantial restoration of colloid can be achieved.

These experiments provide information as to the level of iodine intake at which cellular hypertrophy and colloid loss due, presumably to the processes of endemic goiter, may still be expected to occur. Thus the spontaneous changes in certain animals recorded in Table 1 c appeared with an iodine content of the diet of 6.9 gamma per 100 gm., while the darkened infected group of Table 1 a showed these changes on diets containing from 13.5 to 15.6 gamma per 100 gm.

In summary it may be observed that under the dietary and temperature conditions of the writer's work no decisive evidence was obtained that darkness induces marked colloid loss or cellular hypertrophy in the thyroid gland, nor was it possible by brief irradiation with ultraviolet light to influence unmistakably the hypertrophy induced by cold or the recovery therefrom. If it is true, as some have felt, that light is of great importance to the thyroid of the rat, the circumstances under which this influence can be satisfactorily established remain unknown.

The writer wishes to express his great obligation to Dr. Versa Cole of the Department of Surgery of the Ohio State University School of Medicine for the determinations of the iodine content of the foods used.

7824 P

Sex Difference in White Rat in Tolerance to Certain Barbiturates.

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Using duration of sleep and rate of mortality as criteria, we have verified the Nicholas and Barron[1] finding that the female white rat is much more sensitive to amytal* than is the male, in that on any

[1] Nicholas, J. S., and Barron, D. H., *J. Pharm. and Exp. Therap.*, 1932, **46**, 125.

* The drugs used were kindly furnished by the following firms: amytal, Eli Lilly & Co.; nembutal, Abbott Laboratories; evipan, Bayer Co.; pernocton, Riedel-de Haen, Inc.; hebaral, Parke, Davis & Co.