

*Summary and Conclusions.* While the results are not complete enough to reach definite conclusions, it would seem that in view of similar and better known conditions in rodents the mechanism of the production of the "wedding dress" in *Chrosomus erythrogaster* is due to the action of substances having either a stimulating effect upon the sex glands of the fish, such as prolan, or having an effect similar to that of the estrus producing hormones, such as Yohimbine.

## 7352 C

### Effect of Prolonged Feeding of Raw Carrots on Vitamin A Content of Liver and Kidneys in the Dog.

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The function of carotene in nutrition has been established.<sup>1-4</sup> The advisability of feeding large amounts of raw carrots over a prolonged period of time is still questioned. Carotinemia has been observed in the dog,<sup>5</sup> and in man.<sup>6</sup> Investigations of Moore,<sup>2</sup> Capper,<sup>7</sup> and Drummond<sup>8</sup> have shown that conversion of carotene to vitamin A takes place in the livers of vitamin A-free rats or fowls. Olcott and McCann<sup>9</sup> later confirmed these observations and further concluded that this change may take place *in vitro* if incubated with fresh liver tissue. Rea and Drummond<sup>10</sup> failed to obtain a carotinase in liver preparations from vitamin A-free rats and further obtained no increase in vitamin A content of cat livers after carotene administration.

Table I presents the results obtained by feeding dogs fresh car-

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<sup>1</sup> Euler, Euler and Karrer, *Helv. Chim. Acta.*, 1928, **12**, 278.

<sup>2</sup> Moore, T., *Biochem. J.*, 1930, **24**, 692.

<sup>3</sup> Green, H. N., and Mellanby, E., *Brit. J. Exp. Path.*, 1930, **11**, 81.

<sup>4</sup> Turner, R. G., and Loew, E. R., *J. Inf. Dis.*, 1933, **52**, 102.

<sup>5</sup> Duhig, J. V., *Med. J. Australia*, 1931, **1**, 260.

<sup>6</sup> Curtis, A. C., and Kleinschmidt, E. E., *Ann. Internal Med.*, 1932, **6**, 751.

<sup>7</sup> Capper, N. S., *Biochem. J.*, 1930, **24**, 980.

<sup>8</sup> Drummond, J. C., Ahmad, B., and Morton, R. A., *J. Soc. Chem. Ind.*, 1930, **49**, 291 T.

<sup>9</sup> Olcott, H. S., and McCann, D. C., *J. Biol. Chem.*, 1931, **94**, 185.

<sup>10</sup> Rea, J. L., and Drummond, J. C., *Z. Vitaminforsch.*, 1932, **1**, 177.

TABLE I.  
Vitamin A Content of the Liver and Kidneys in the Dog.

| gm. Diet          | Dog No. | Animal Units of Vitamin A |        |       | Days on Diet |
|-------------------|---------|---------------------------|--------|-------|--------------|
|                   |         | Liver                     | Kidney | Total |              |
| 150 meat**        | 51      | 12.6                      | 8.0    | 20.6  | 63           |
| 150 boiled rice†  | 52      | 14.4                      | 4.0    | 18.4  | 63           |
|                   | 50      | 16.0                      | 6.02   | 22.02 | 63           |
| 150 fresh carrots | 1       | 11.0                      | —      | —     | 240          |
|                   | 4       | 26.6                      | 12.1   | 38.7  | 224          |
| Aver.             |         | 16.1                      | 7.53   | 24.93 |              |
| 150 meat          | 54      | 4.03                      | 1.01   | 5.04  | 15           |
| 150 boiled rice   | 55      | 4.52                      | —      | —     | 49           |
| Aver.             |         | 4.27                      | 1.01   | 5.04  |              |
| 150 meat          |         |                           |        |       |              |
| 150 boiled rice   | 5       | 15.5                      | 7.9    | 23.4  | 240          |
|                   | 6       | 14.1                      | 4.8    | 18.9  | 240          |
| 150 fresh carrots | 3       | 16.6                      | —      | —     | 96           |
| 10 cc. C.L.O.     |         |                           |        |       |              |
| Aver.             |         | 15.4                      | 6.35   | 21.1  |              |

\*\* Maro dog meat from Chappel Bros., Inc., Rockford, Illinois.

† Boiled rice was prepared by boiling 1,000 gm. rice in 2,000 cc. water to which was added 2% NaCl and 3%  $(\text{Ca})_3(\text{PO}_4)_2$ .

The figures presented represent the amount of vitamin A per gram of tissue.

rots over a prolonged period of time (2 to 8 months). Five of the animals received a diet of meat, boiled rice and fresh carrots; 3 received a similar diet with the addition of 10 cc. of cod liver oil daily, and 2 were deprived of both carrots and cod liver oil. The 2 dogs receiving only meat and boiled rice succumbed at 15 and 49 days. Previous to this their appetite became sporadic, there was marked discharge from the nose and eyes and in all the symptoms were those of distemper. The remaining dogs continued to maintain or gain in weight and appear healthy and vigorous. They were killed and autopsied at varying times. No signs of carotinemia were observed in any of the dogs. The liver and kidneys were removed at necropsy and prepared for vitamin A estimation by the method of Moore.<sup>2</sup>

The colorimetric estimation was carried out by the method of Norris and Danielson.<sup>11</sup> The dilutions of the extracted tissue oils were made so that the readings were below 2 blue Lovibond units. Norris and Church<sup>12</sup> have reported that the Carr-Price reaction at this low color value gives results less than 10% in error and that the color curve for vitamin A more closely approaches a linear function. The results are presented in animal units of vitamin A per gram

<sup>11</sup> Norris, E. R., and Danielson, I. S., *J. Biol. Chem.*, 1929, **83**, 469.

<sup>12</sup> Norris, E. R., and Church, A. E., *J. Biol. Chem.*, 1930, **85**, 477.

of tissue. According to Rosenheim<sup>13</sup> an animal unit is that amount of vitamin A which produces a color equivalent to 10 Lovibond standard blue units. This amount restores normal growth to rats on a diet otherwise free from vitamin A. Spectroscopic examination of the blue color formed by the antimony trichloride reaction on oils obtained from both kidney and livers showed a characteristic sharp band at 608-610 Mu with an indefinite diffused band at 330-328 Mu.

In general the liver and kidneys from dogs living 63 to 240 days on a diet containing 150 gm. of fresh carrots showed approximately the same amount of vitamin A. In only one case, dog 4, was there a marked increase encountered. This dog remained on the diet for 224 days. The total vitamin content for both organs was 38.7 A. U. as compared to 22.02 A. U. found in dog 50 which is the highest result found after feeding for 63 days. The average vitamin A content for the carrot-fed dogs is 16.1 A. U. per gram of liver and 7.53 A. U. per gram of kidney. This is approximately 4 times the amount found in the same organs of dogs receiving no carrots (dogs 54 and 55). According to Moore<sup>14</sup> 16.5 A. U. is equivalent to 1 mg. of carotene. The 3 dogs receiving cod liver oil in addition to the 150 gm. of carrots showed no further increase in the vitamin A content of the 2 organs than encountered in the carrot-fed dogs, averaging 15.4 A. U. per gram of liver and 6.35 A. U. per gram of kidney.

*Summary.* The vitamin A content of the liver and kidneys of dogs fed fresh carrots is greater than that found in dogs on a meat and boiled rice diet. The level of the vitamin A concentration in the liver and kidneys is approximately 20 vitamin A animal units. Continued feeding of carrots or addition of cod liver oil apparently does not increase the vitamin A content above this level. The spectroscopic examination indicates that the carotene from the carrots was transformed to vitamin A.

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<sup>13</sup> Rosenheim, O., *Biochem. J.*, 1927, **21**, 1329.

<sup>14</sup> Moore, T., *The Lancet*, August 24th, 1929, 380.