LXXXV. UROCHROME AS A DERIVATIVE OF CHLOROPHYLL.

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IN a series of papers Palmer and his co-workers have shown that many animal pigments are derived from carotene and xanthophyll [Palmer and Eckles 1914; Palmer and Kempster 1919], therefore it was thought desirable to find out if urochrome also is derived from plant pigments.

Preliminary experiments were performed with human urine. The urine was collected in twenty-four hour samples, preserved with chloroform and the urochrome was extracted by the method of Garrod [1874] from one tenth of each daily quantity and the alcohol extracts were compared by a colorimeter.

By restricting the amount of plant pigments in the diet the colour extracted by the above method was reduced by about one fifth. This led to experiments being carried out using guinea-pigs, as it is possible to give them diets with greater variation in plant pigments. The urochrome was extracted as above by Garrod's method and the amount of colour was estimated from the volume of the extract and its depth of colour.

The experiments show that a diet deficient in plant pigments is associated with a urine deficient in yellow pigment. As the chemical composition of urochrome indicates that it is an acid substance giving reactions for pyrrole [Dombrowski, 1907], and might be a derivative of chlorophyll [Willstätter and Stoll, 1913], further experiments were carried out contrasting a diet containing carrots with one containing green pigments (carrot tops) with the result that the green parts of plants caused a marked increase in the amount of colour in the urine whilst the yellow pigments did not show any appreciable effects.

The experiments are so easy of repetition that full experimental details need not be given. One experiment on a guinea-pig is included to show the extent of variations in colour produced by changes in diet.

Guinea-pig weight 335 g.

Date 1921	Diet	Volume of urine c.c.	Relative colour of extract
30. v.	Bread and greens	discarded	
31. v.-2. vi.	" "	69	127
2-4. vi.	" "	72	216
4-6. vi.	Bread and apple	discarded	
6-8. vi.	" "	32	60
8-10. vi.	" "	45	41
11-13. vi.	Bread and carrots	discarded	
13-15. vi.	" "	53	48
15-17. vi.	" "	95	39

This experiment shows the striking effect of greens in the diet on the colour of the urine. The averages are: diet containing carotene 44, diet without obvious pigments 51, diet with chlorophyll in addition to carotene 172.

If urochrome is a derivative of chlorophyll one ought to expect to obtain similar pigments, for instance during digestion, from parts of plants which contain chlorophyll. Pigments agreeing with urochrome in colour, in absence of absorption bands in the visible portion of the spectrum and in solubilities have been obtained by direct extraction from hay and tea leaves; and from cabbage and spinach on treatment with dilute acid followed by alkali.

Pelkan [1920] states that urochrome is related to the protein in the diet. His results may be due to plant derivatives associated with the proteins used. In this connection it should be noted that the colour of milk whey is due to a pigment similar to urochrome. [Palmer and Cooledge, 1914.]

SUMMARY.

Green parts of plants increase the output of urochrome in the urine whereas carotene does not. In view of the chemical similarity of chlorophyll derivatives and urochrome it seems probable that urochrome is a derivative of chlorophyll.

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