

cial equipment and services essential thereto will be paid from that fund. The agreement will stipulate the estimated cost of the undertaking, which will include an amount to be retained by the institute for overhead expenses. The sponsor of the undertaking will be kept informed as to the progress of the work and will be expected to lend active support to the program by making available to the institute special knowledge and experience relative to the undertaking at hand, and such specialized facilities as may be indicated to be of aid in the solution of the sponsor's research problem.

Any discoveries growing out of a sponsored investigation shall become the exclusive property of the project sponsor, and it will be incumbent on the institute to assign all rights, patents and titles to the sponsor. There may be an occasional exception in the application of this principle in cases where the investigation has originated in the institute or involves some special knowledge already acquired by the institute in its own researches. The institute is bound to complete secrecy as to the developments and will agree that no publication thereof shall be made for a stipulated period without consent of the sponsor. Although the Southern Research Institute has been established to provide new research facilities in the South, the acceptance of sponsored research projects will not be limited by any specific geographical considerations.

The Southern Research Institute now has in excess of \$500,000 in capital, all contributed by business en-

terprises and persons in the southern states. In general the contributors are manufacturing enterprises to whom facilities and scientific skill will be available on a fee basis; trade and service establishments who will share in the region's expanded purchasing power; public utilities who inescapably feel the impact of generally higher economic attainments; agriculturists whose markets are likely to be broadened; trade and industrial associations who enjoy in common the benefits of increased basic knowledge of their mutual products; and finally those engaged in the professions whose welfare is dependent on that of the community at large.

For the duration of the emergency, the closest attention is being given to providing added research and testing facilities of interest to the war agencies and to aiding local manufacturers engaged in the production of war materials.

Current funds are sufficient to equip the institute and to insure operations for its initial period, or until the institute can be made self-supporting. As the scope of usefulness of the Southern Research Institute increases, further additions to the institute's capital funds will no doubt be needed. A genuine and substantial interest in research is spreading throughout the South which gives friends of the institute confidence that the necessary funds for a healthy growth will be forthcoming.

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SPECIAL ARTICLES

ROLE OF FAT IN INCISOR DEPIGMENTATION OF VITAMIN E-DEFICIENT RATS¹

It has been reported^{2, 3} that the normally brown-yellow pigment of maxillary rat incisor teeth disappears when the animal suffers from vitamin E deficiency. Development of an orange-brown coloration in the adipose tissue of E-deficient rats has been shown by one of us⁴ to depend on the presence of certain unsaturated fats in the diet. In order to investigate a possible relationship between such dietary fat and dental depigmentation, we established five groups of animals comprising 6 newly weaned rats, and reared them for 80 days on the following diets:

Group 1 (vitamin E deficient, fat free): Sugar 65 per cent.; casein, alcohol-extracted, 20 per cent.; dried yeast, ether-extracted, 10 per cent.; salt mixture no. 2, U.S.P., 5 per cent.; tetrasodium salt of 2-methyl-1,4-

naphthohydroquinone diphosphoric acid, 1 mg; vitamin A and D concentrate in oleic acid, 2 drops weekly per animal corresponding to 560 i.u. A and more than 80 i.u. D. Group 2 (vitamin E containing, fat free): Same as group 1 plus 10 mg per cent. of d,l-alpha-tocopherol acetate. Group 3 (vitamin E deficient, high fat): Same as group 1 but with 20 per cent. sugar replaced by 20 per cent. cod liver oil. Group 4 (vitamin E containing, high fat): Same as group 3 plus 10 mg per cent. d,l-alpha-tocopherol acetate. Group 5 (normal control) was fed dog chow.

Degree of pigmentation was recorded weekly by comparison with a scale of colors, 1 to 10, 1 being the color of pigment-free mandibular incisors in just-weaned animals, 10 the brown-yellow color of pigmented maxillary incisors in normal adult animals.

Animals in groups 1, 2 and 4 developed incisor pigment essentially in the same way as group 5, color intensity increasing from 2.5 in maxillary incisors and from 1 in mandibular. In group 3, pigmentation of the maxillary incisor teeth occurred as in other

¹ Aided by grants of the Carnegie Corporation of New York, Eastman Dental Dispensary of Rochester, and Wyeth, Inc., Philadelphia.

² A. W. Davies and T. Moore, *Nature*, 147: 694, 1941.

³ T. Moore, *Biochem. Jour.*, 37: 112, 1943.

⁴ H. Dam, *Jour. Nutrition*, 27: 193, 1944.

groups until about the 20th day, when an abrupt disappearance of pigment was observed at the gingival margin. Thereafter, depigmented enamel progressively replaced pigmented enamel as the teeth erupted. All animals in group 3 had bluish-white incisor teeth after 45 days (indicated as 0 in Fig. 1), although a few retained small yellow areas on a depigmented background. Mandibular incisors of this group presented no significant deviation of pigmentation as compared with those of other groups. However, rats fed a similar diet for a greater length of time exhibited an irregular depigmentation of these teeth.⁵ Fig. 1 shows changes of pigment observed in the five groups.

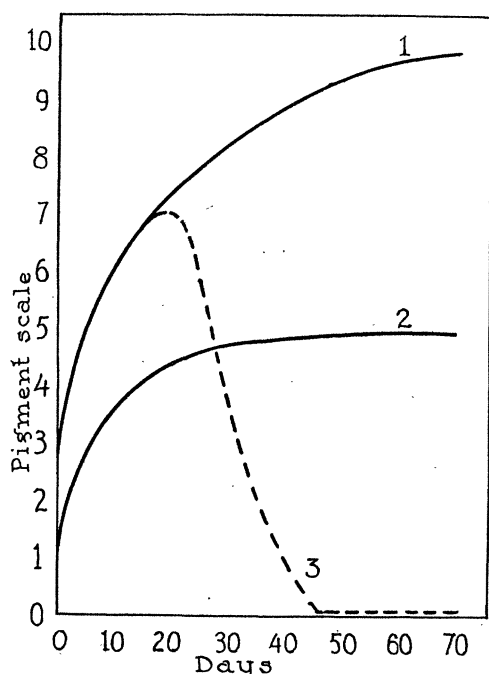


FIG. 1. Line 1 indicates upper incisor pigmentation in groups 1, 2, 4 and 5. Line 2 represents lower incisor pigmentation of all 5 groups. Line 3 shows upper incisor pigmentation of group 3.

No particular differences in eruption and attrition of incisor teeth were found in animals of the first four groups, but in group 5 these processes took place at a somewhat higher rate. Depigmentation was not correlated with any change in the rate of eruption and attrition. The average weight at the end of the experiment was slightly higher in groups 4 (194 g) and 5 (205 g) than in preceding groups (142, 153 and 160 g). Scaly tail developed in all animals on fat-free diets (1, 2). Autopsy revealed brown coloration of adipose tissue only in group 3, confirming previous observations.

⁵ H. Granados, K. E. Mason and H. Dam, *Jour. Dental Research* (Proc. 23rd General Meeting International Association for Dental Research), 1945.

These results indicate that depigmentation of incisors in vitamin E-deficient rats requires the presence of fat, presumably unsaturated fatty acids, in the diet, a finding which suggests that the phenomenon is related to some abnormal deposition or reaction of fat in the ameloblasts. A previous observation⁶ of persistence of dental pigment in rats reared on an E-deficient diet for 167 days can not be compared with our findings, due to the fact that the diet used was not reported. It is possible that this contradictory finding could be explained by differences in dietary fat content.

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URINARY EXCRETION OF PENICILLIN IN MAN AFTER ORAL ADMINISTRATION WITH GASTRIC ANTACIDS¹

WHEN given by mouth, penicillin is reported to be destroyed by stomach acid.^{2, 3} In subjects suffering from achlorhydria, penicillin is absorbed into the blood after oral administration.³ Penicillin has been detected in the blood when given by mouth together with sodium bicarbonate.³ Urine recoveries of intravenously and intramuscularly injected penicillin are reported to average approximately 60 per cent.⁴

These reports suggested to one of us (H.E.A.) that neutralization of gastric acidity might permit the absorption of a significant quantity of penicillin when the drug was given by mouth.

In our first series of experiments, approximately 20,000 units of penicillin in 200 ml of solution containing the antacid to be tested were given by mouth two hours after the morning meal. The percentages of the dose excreted in the urine during each two-hour period thereafter were estimated turbidimetrically using *Staphylococcus aureus* 6538 as the test organism. The unknown samples were compared with standard penicillin curves which were prepared in duplicate each day.

It was found that when penicillin was administered by mouth alone under these conditions, no more than 3 per cent. of the dose was recovered.

When 5 gm trisodium citrate ($\text{Na}_3\text{C}_6\text{H}_5\text{O}_7 \cdot 5\frac{1}{2}\text{H}_2\text{O}$)

⁶ J. T. Irving, *Nature*, 150: 122, 1942.

¹ This manuscript was submitted for publication in *SCIENCE* under date of December 9, 1944.

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² C. H. Rammelkamp and C. S. Keefer, *Jour. Clin. Invest.*, 22: 425, 1943.

³ C. H. Rammelkamp and J. D. Helm, Jr., *Proc. Soc. Exp. Biol. and Med.*, 54: 324, 1943.

⁴ C. H. Rammelkamp and S. E. Bradley, *Proc. Soc. Exp. Biol. and Med.*, 53: 30, 1943.