

morning by examining uncovered drops with a low power objective with dark field illumination. All the pre-inoculation bleedings were negative and the antibody response was very variable. Of six, 6-week-old birds, 3 developed no agglutinins at all and 3 developed titers of only 1:40. Among the 2- to 5-month-old birds, levels of 1:800 to 1:8000 were reached and during a 2- to 3-month period of observation these titers did not fall appreciably.

Since the successful demonstration of infection in subcutaneously inoculated birds was demonstrated in only 2 instances the actual number of infections accomplished cannot be stated since the antibody response in older birds may have resulted from the antigenic stimulus of the inoculum. This possibility was eliminated in another experiment in which 5 birds were given the organism by feeding. Each bird received 1 cc of a fluid leptospiral culture drop by drop with a pipette, care being taken that the material was slowly swallowed and that the mucous membranes were not traumatized.

Three weeks later all 5 birds had developed specific serum antibodies in titers ranging from 1:800 to 1:3200. This established the susceptibility of domestic fowls to infection in a manner which could well occur in nature. The actual occurrence of infection in nature remains to be demonstrated.

More than 500 chicken sera, from several flocks, have been examined for their agglutinin titer with bovine leptospira and *L. icterohaemorrhagiae* and while titers of 1:20 and 1:40 were frequently observed these are not considered significant. Two sera were found with titers of 1:400 with both strains and one serum which was positive at 1:200 with the bovine strain only. These serological findings though not adequate in themselves, suggest the occurrence of leptospira infections in chickens in nature.

Summary. Domestic chickens were shown to be susceptible to experimental infection with a bovine strain of leptospira, when given subcutaneously or by mouth. The infection occurs in inapparent form, as a rule.

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Influence of Fluorine in Mottled Teeth on Dental Caries.*

VIRGIL D. CHEYNE.

From the Department of Pedodontics, College of Dentistry, University of Iowa, Iowa City, Ia.

If compounds of fluorine are to be used as drugs in combating human dental caries,¹ eventually the manner of action must be explained in order to direct their most practical application. At present the literature assumes that it works (1) through a constant intake of fluorine-bearing water² or (2) by

direct chemical combination with the constituents of the tooth, introduced either prenatally³ or postnatally.⁴ The latter assumption has been contested by the presentation of data which shows that a significant effect of fluoride acquired after tooth eruption on induced rat caries is not evident.⁵ Using

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¹ Editorials, *J. A. D. A.*, 1947, **34**, 345; *J. A. D. A.*, 1947, **34**, 411.

² Dean, H. T., *Am. J. Ortho. and Oral Surg.*, 1947, **33**, 49.

³ Cox, G. J., Matuschak, M. C., Dixon, S. F., Dodds, M. L., and Walker, W. E., *J. D. Res.*, 1939, **18**, 481.

⁴ Armstrong, W. D., and Brekhuis, P. J., *J. D. Res.*, 1938, **17**, 393.

⁵ McClure, F. J., *J. Nutrition*, 1941, **22**, 391.

TABLE I.

Group	Condition of animal	No. of animals	No. of molar teeth examined	No. fractured cusps per animal	No. carious cuspal involvements per animal	No. carious teeth per animal
I	Normal	15	180	10.9	4.0	1.8
II	Extirpated salivary glands	12	144	4.9	36.6	10.6
III	Mottled molars	9	108	20.0	5.4	1.5
IV	Extirpated salivary glands and mottled molars	9	108	12.6	28.1	8.5

a technique for desalivating rats worked out in our laboratory,⁶ it has been possible to demonstrate that a continuous supply of fluorine will arrest caries in the absence of saliva.⁷ The present report is based upon further studies with desalivated animals. Using the technique in combination with a method for increasing the fluorine content of rat molars, also worked out in our laboratory,⁸ it has been possible to remove the influence of saliva in animals previously subjected to fluorine in sufficient amounts to cause mottling during prenatal life and test the influence of the fluorinated tooth acting alone against caries-producing conditions.

Experiments and Results. A total of 18 rats were obtained from three mothers which had been receiving daily concentrations of 300 to 350 parts per million of fluorine as potassium fluoride during pregnancy, and a total of 27 young were selected from five mothers which received no fluorine. All parents were from the same Wistar breeding stock. One-half of the fluorinated young and 12 of the 27 nonfluorinated young were subjected to total salivary gland extirpations at the age of 24 days. On the 42nd day all animals were placed on a caries-producing diet.⁹ The food and distilled water were given *ad lib*. Weights were taken every 4 days. After 104 days on the diet, the animals were chloroformed, the jaws were separated, and all molar teeth examined with a sharp explorer tine under a binocular microscope, magnification 30X. Several sagittal planes

of jaw segments were examined histologically in ground and decalcified section to confirm the accuracy of the diagnosis. Lesions were classified into simple fractures and carious cavities. Presumably mechanical fracture of rat molars precedes most experimental carious destruction. Male and female differences were not sufficiently significant to warrant separate consideration in any group.

Observation in Table I shows that the reduction of saliva greatly increases the incidence of rat caries. This also has been demonstrated in a previous publication by us.¹⁰ Normal animals on the caries-producing diet average 4.0 carious cuspal involvements and 1.8 carious teeth per animal; those with salivary glands extirpated average 36.6 carious cuspal involvements and 10.6 carious teeth per animal; those with mottled molars average 5.4 carious cuspal involvements and 1.5 carious teeth per animal; and desalivated rats with mottled molars average 28.1 carious cuspal involvements and 8.5 carious teeth per animal. The number of cavities in the lower teeth exceeded those in the upper for all animals examined. Because the average number of carious teeth in the third group is only slightly lower than normal it seems that the fluorine incorporated in the tooth substance has very little, if any, influence in retarding caries. The greater number of carious cuspal involvements in the same group gives added support to this assumption. The outstanding conclusions, however, are based upon a comparison of the last group with the remaining three. Desalivated animals with mottled molars show an increase of approximately 80% of carious

⁶ Cheyne, V. D., *J. D. Res.*, 1939, **18**, 457.

⁷ Cheyne, V. D., *Proc. Soc. Exp. Biol. and Med.*, 1940, **43**, 58.

⁸ Cheyne, V. D., *J. D. Res.*, 1942, **21**, 145.

⁹ Hoppert, C. A., Webber, P. A., and Canniff, T. L., *J. D. Res.*, 1932, **12**, 161.

¹⁰ Cheyne, V. D., *Proc. Soc. Exp. Biol. and Med.*, 1939, **42**, 587.

lesions over normal animals and only about 20% reduction compared to desalivated animals not subjected to fluorine in their prenatal period. The relatively low number of fractures in nonfluorinized animals subjected to desalivation suggests that early breaks rapidly become carious. The higher number of fractures in the normal animals indicates the reverse condition, but in the fluorinized animals of Groups 3 and 4 it would be difficult to say to what degree the high frequency of breaks was due to greater friability of hypoplastic fluorinized teeth.

Summary. Some of the factors operative

in suppressing rat caries have been tested in this experiment. By using animals in which the salivary glands have been removed it has been possible to test the relative effects of fluorine prenatally incorporated in the teeth. When the caries score of operated rats with mottled or fluorinized teeth are compared with that of nonfluorinized animals without glands there is a measurable reduction in caries. When the percentage of reduction is compared with the caries score of normal animals, however, there is evidence that the saliva offers greater protection than the fluorine in tooth substance.

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Prevention of the Anti-Curare Action of Epinephrine by Dibenamine.

W. O. MADDOCK, V. M. RANKIN, AND W. B. YOUMANS.

From the Department of Physiology, University of Oregon Medical School, Portland.

The effects of N, N-dibenzyl-beta-chloroethylamine (Dibenamine) on the responses of various visceral effectors to epinephrine have been studied by Nickerson and Goodman.¹ They have reported adrenolytic actions of Dibenamine in various visceral effectors which have an excitatory adrenergic innervation. Epinephrine is known to exert an anti-curare action at the skeletal neuromuscular junction.^{2,3} The mechanism of this action is unknown. It does not appear to be related to any influence on adrenergic neuro-effector systems. In the present study it is demonstrated that Dibenamine prevents the anti-curare action of epinephrine.

Methods. Seven dogs were used. Intravenous sodium pentobarbital was the anesthetic employed in 6 dogs. In one animal, intratracheal ether anesthesia was used following the administration of 15.0 mg morphine sulfate. The peripheral portion of the

cut peroneal nerve was drawn across 2 glass-shielded platinum electrodes, and single shocks of supramaximal strength were applied every 2 seconds by means of an electronic stimulator (Electrodyne, model 461). Relatively isometric contractions of the tibialis anticus muscle were recorded on a revolving drum by means of a Meyerhof type of myograph. The femoral artery of the same side was exposed for intra-arterial injections. The femoral vein of the opposite side was exposed for intravenous injection.

The curare preparation used was Intocostrin, 20 units per cc (E. R. Squibb and Sons). This preparation has the same potency as a solution containing 2.7 mg of anhydrous d-tubocurarine chloride per cc. The following general procedure was used in each of the 7 experiments. Intocostrin was diluted with isotonic saline so that each cc contained 2 units, and this was injected intravenously in amounts sufficient to depress the amplitude of muscular contraction to between one-fourth and one-half of the original height. Then epinephrine (Adrenalin, Parke-Davis and Co.) was injected rapidly intra-arterially. After demonstrating the anti-curare action of

¹ Nickerson, M., and Goodman, L., *J. Pharm. and Exp. Therap.*, 1947, **89**, 167.

² Rosenblueth, A., Lindsley, D. B., and Morison, R. S., *Am. J. Physiol.*, 1936, **115**, 53.

³ Wilson, A. T., and Wright, S., *Quart. J. Exp. Physiol.*, 1936-37, **26**, 127.