

BIOLOGY

Birefringence of Enamel Organic Matrix

To date little attention has been given to the appearances of the enamel organic matrix when examined between crossed nicols, and the few published observations show considerable disagreement. Cape and Kitchin¹, and Poole² reported that the enamel organic matrix is without intrinsic birefringence. Keil³ and Schmidt⁴ reported a weak positive intrinsic birefringence—the sign being described with respect to the long axis of the enamel prisms. Rushton⁵ stated that this positive birefringence is strong, in fact stronger than the negative intrinsic birefringence of the mineral matter present in the mature tissue.

During current studies on the optical properties of dog enamel, results were obtained which support the views of Keil and Schmidt. In these studies ground sections, approximately 300 μ in thickness, prepared from the developing maxillary permanent incisors of a two months old dog were demineralized in a formic and citric acid mixture. The demineralized sections were first imbibed for periods of 24 hr. in each fluid of a series prepared by mixing varying proportions of cedarwood oil ($n_D=1.505$) and monobromnaphthalene ($n_D=1.659$), and then examined between crossed nicols in monochromatic light—a sodium lamp being used as light source. The refractive indices of the imbibition fluids, determined with an Abbe refractometer, ranged from 1.505 to 1.598 by intervals of approximately 0.01. The retardation at selected points on the specimens was measured in each fluid by means of a Berek compensator.

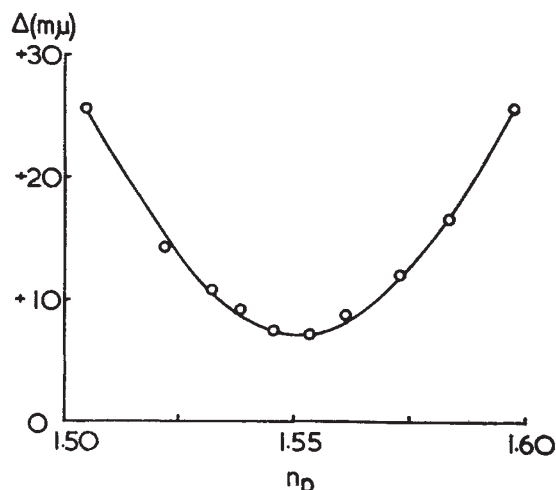


Fig. 1. Retardation of the enamel organic matrix as a function of the refractive index of the imbibition fluid

The type of imbibition curves thus obtained (Fig. 1) clearly indicates that in demineralized developing dog enamel organic matrix there is an interaction between positive form birefringence and positive intrinsic birefringence. Allowing for possible variations in prism direction giving rise to a crossed lamellar system⁶, the strength of the positive intrinsic birefringence appears to be not less than 0.00002. Further, the refractive index of the organic matrix at this stage of development is shown by the imbibition curves to be about 1.55—a value confirmed by Becke line tests.

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¹ Cape, A. T., and Kitchin, P. C., *J. Amer. Dent. Ass.*, **17**, 193 (1930).

² Poole, D. F. G., *Quart. J. Micro. Sci.*, **98**, 349 (1957).

³ Keil, A., *Z. Zellforsch.*, **22**, 633 (1935).

⁴ Schmidt, W. J., *Z. Zellforsch.*, **49**, 319 (1959).

⁵ Rushton, M. A., *Brit. Dent. J.*, **87**, 1 (1939).

⁶ Frey-Wyssling, A., "Submicroscopic Morphology of Protoplasm and its Derivatives" (Elsevier, Amsterdam, 1948).

Placental Grafts in Rats

DURING studies of experimental infection of the rat placenta attempts were made to transplant placental tissue from the uterus to the mother's omentum. Grafts of the allanto-chorion were not successful; but the yolk sac membrane, when transplanted at 15 days pregnancy, grew in a most remarkable manner.

After a number of pilot experiments the following technique was adopted. The abdominal cavities of rats (Albino Wistar strain) at 15 days pregnancy were opened under open ether anaesthesia. The uterus with its contained conceptuses was removed, but the ovaries left intact. A portion of yolk sac was carefully dissected from a placenta and returned to the mother's peritoneal cavity where it was wrapped in the omentum. The abdominal wound was then closed.

Of 12 rats treated in this manner all except one showed evidence of transplant growth at autopsy 4, 8 or 12 weeks later. Seven transplants grew into large mucus-containing cysts, the largest being more than 2 in. in diameter (Fig. 1). On histological examination a variety of tissues were frequently found together in the same graft. These included epidermoid cysts containing keratin and hair, hair follicles, sebaceous and sweat glands, mucus-secreting epithelium, whorled masses of mesenchyme connective tissue, smooth and striated muscle, cartilage and bone. The mucus-secreting epithelium was usually organized with other tissues so as to resemble gut wall, in that there were villi and surrounding layers of smooth muscle (Fig. 2).

The possibility of dependence of these grafts on hormones has been briefly investigated; removal of the

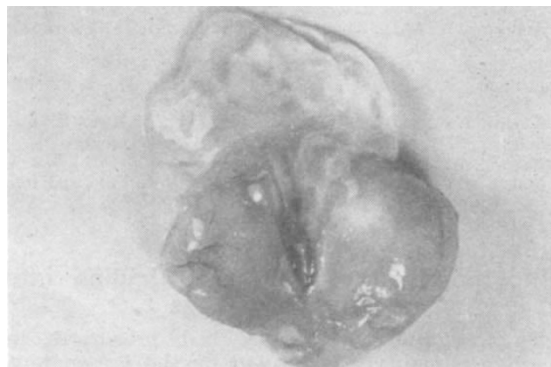


Fig. 1. Rat yolk sac graft to omentum, 12 weeks after transplantation. It has grown to more than 2 in. in diameter and contains large quantities of mucus