tent, it is apparent that there is not a 1-to-1 relationship between the water content of seeds and their sensitivity to x-rays. This suggests that reduced seedling height resulting from x-radiation is not simply related to the production of active radicals in the presence of water.

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4. This research was carried out at the Brookhaven National Laboratory under the auspices of the U.S. Atomic Energy Commission in cooperation with the U.S. Department of Agriculture.
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10 September 1954.

In vitro Studies of Dental Decay*

The concept of studying the carious process by using extracted human teeth under *in vitro* conditions was realized and applied early in the development of dental research. E. Magitot (1870) and W. D. Miller (1890) described carious lesions produced in this manner (*1*).

Recently the value of *in vitro* studies has been increased by the development of the "artificial mouth" (*2*). For this work, extracted human teeth are mounted singly or in pairs. The mounted teeth are placed in cylindrical funnels, and a bacteriological medium ("artificial saliva") is allowed to flow dropwise over the teeth for several months. At weekly intervals, the teeth are inoculated with pooled samples of human saliva and rapidly become covered with a mass of microorganisms.

Some of the most important factors that have been found to influence the destruction of the teeth are the following. Tooth destruction can be quite general, if localizing factors are not present. If the teeth are cleansed regularly, destruction will be confined mainly to the noncleansed areas, to previously abraded areas, and to the cervical areas. Old teeth appear to be more resistant than young or unerupted teeth, and there is evidence for the presence of a protective surface film (*3*). The attack is greatly influenced by the amount of D-glucose in the nutrient medium. With only a small amount present (< 0.10 percent), sound teeth remain unchanged for long periods. In the presence of a relatively large amount (for example, 0.5 percent D-glucose), enamel attack and decalcification of exposed dentin proceed rapidly. At intermediate concentrations (0.2 to 0.3 percent), both decalcification and dentinal matrix destruction occur, so that the entire tooth structure will be destroyed.

More recently, several additional important observations have been made. Because of the considerable delay in publication and a desire to extend this work before publication, a brief summary is presented here.

Reidar F. Sognnaes (Harvard School of Dental Medicine) has examined histologically thin sections from a number of teeth with localized lesions of enamel and of dentin, produced in the "artificial mouth." The sections were found to exhibit a number of features associated with natural lesions. According to Sognnaes, these are the following. (i) Accumulation of plaques containing gram-positive microorganisms has been demonstrated on tooth surfaces subjected to various bacterial substrates in the "artificial mouth." (ii) The primary penetration of the enamel appeared to proceed between the prisms, accompanied by accentuation in the appearance of the prisms, the cross-striations, and the incremental lines, eventually followed by a loss of surface continuity. (iii) Invasion of the dentin occurred along characteristic tracts, indicated by greater permeability to dyes and, eventually, followed by loss of tooth substance and cavity formation. (iv) A predominance of gram-positive spheroid microorganisms could be demonstrated within distended dentinal tubules, eventually invading the ramifications of the tubules and destroying the intertubular matrix.

More recently, several experiments have been concluded in which the attack was brought about by single strains of microorganisms. Under conditions such that both decalcification and dentinal matrix destruction would occur with mixed cultures, it was found after 3 mo that an oral *Lactobacillus casei* strain produced decalcification but did not affect the matrix. On the other hand, an oral *Streptococcus salivarius* strain (found later to have become contaminated with a micrococcus) produced decalcification and matrix destruction. The partially attacked dentin was brown and leathery. These experiments are being repeated and extended to other microorganisms. In view of the usually accepted role of lactobacilli in the carious process, these results seem particularly interesting.

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References and Notes

* This work has been aided by a contract between the Office of Naval Research, Department of the Navy, and the University of Alabama (NR 180-017).
1. The work in this field will be reviewed by the present author in a forthcoming article.
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25 June 1954.