DETERMINATION OF THE PRESENCE AND PROPERTIES OF EXTRACELLULAR CARBOHYDRATE HYDROLASES FROM SELECTED ORAL ACTINOMYCES

by

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The thesis here presented was written under the direction of Dr. Chris H. Miller and approved by Drs. Dietrich C. Bauer, Donald J. Niederpruem and Warner S. Wegener as members of the examining committee, of which Dr. Miller was Chairman.

An investigation was undertaken to elict possible mechanisms relating to the ability of Actinomyces naeslundii and Actinomyces viscosus to cause caries formation and periodontal disease. These processes would include the ability of the organisms to penetrate tissue, cause inflammation and evenual tissue destruction. Equally important would be an understanding of the mechanisms of bacterial utilization of carbohydrates. Ingested sugars have been implicated as being energy sources, plaque-forming matrixes and acidogenic. All of these properties would greatly influence the pathogenic properties of the bacteria.

Both bacteria upon injection into test animals showed ability to invade tissue. Histological examination indicated acute inflammation, insipiant tissue breakdown and actinomycotic lesions, which gave the characteristic "sulfur

"granule" appearance.

Plaque-forming ability of the bacteria upon varying carbohydrate sources was also tested. Data revealed the amounts of plaque formed varied with the carbohydrate added with sucrose supplementation consistantly yielding the highest amounts.

Extracellular carbohydrate hydrolases were examined using sucrose and raffinose as substrates. Actinomyces viscosus exhibited greater activity toward both substrates than did Actinomyces naeslundii. Optimal conditions were ascertained and enzyme kinetics proved consistant over several trials. True invertase activity was proved when it was found that free glucose made up one-half of the total reducing sugar present.

Extracellular enzyme preparations were also tested against the extracellular levan polysaccharide of Actinomyces viscosus.. Both bacteria showed the ability to release reducing sugar from the polymer. However, the enzyme from Actinomyces viscosus showed a much greater affinity for levan than did Actinomyces naeslundii's enzyme.