



AP Bio

FRQ Fridays

2017 #7
Metabolism and Population Size



FRQ Friday #10

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Many species of bacteria grow in the mouths of animals and can form biofilms on teeth (plaque). Within plaque, the outer layers contain high levels of oxygen and the layers closest to the tooth contain low levels of oxygen. The surface of the tooth is covered in a hard layer of enamel, which can be dissolved under acidic conditions. When the enamel breaks down, the bacteria in plaque can extract nutrients from the tooth and cause cavities.

Certain types of bacteria (e.g., *Streptococcus mutans*) thrive in the innermost anaerobic layers of the plaque and are associated with cavities. Other types of bacteria (*Streptococcus sanguinis*) compete with *S. mutans* but are unable to thrive in acidic environments.

- (a) **Identify** the biochemical pathway *S. mutans* uses for metabolizing sugar and **describe** how the pathway contributes to the low pH in the inner layers of plaque.

Identification	Description
fermentation	(lactic) acid/lactate
anaerobic respiration	acid
glycolysis	(pyruvic) acid/pyruvate



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a.) The biochemical pathway *S. mutans* uses for metabolizing sugar is ~~anaerobic~~ fermentation since they live in anaerobic conditions which don't allow oxygen. Fermentation contributes to the low pH in the inner layers of plaque since fermentation generates acids such as lactic acid ~~when the~~ when the bacterium undergoes glycolysis creating pyruvate and changing that into a type of acid lowering the pH in the inner layers of plaque.



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- (b) Normal tooth brushing effectively removes much of the plaque from the flat surfaces of teeth but cannot reach the surfaces between teeth. Many commercial toothpastes contain alkaline components, which raise the pH of the mouth. **Predict** how the population sizes of *S. mutans* AND *S. sanguinis* in the bacterial community in the plaque between the teeth are likely to change when these toothpastes are used.

Prediction (1 point)

- *S. mutans* decreases AND *S. sanguinis* increases



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Prediction (1 point)

- *S. mutans* decreases AND *S. sanguinis* increases

b.) When alkaline toothpastes are used the population of *S. sanguinis* will increase since they are able to survive in non-acidic environments. The population of *S. mutans* will decrease since *S. mutans* can't survive in alkaline conditions (only in acidic ones).





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