

# Periodic graphics

A collaboration between C&EN and Andy Brunning, author of the popular graphics blog **Compound Interest**

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To see more of Brunning's work, go to **compoundchem.com**. To see all of C&EN's Periodic Graphics, visit **cenm.ag/periodicgraphics**.

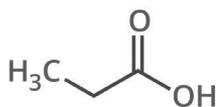
## THE CHEMISTRY OF DENTISTRY

Chemistry plays a number of roles in dentistry, from helping prevent cavities to whitening teeth. Here we examine the molecules behind tooth decay and those used to block or treat it.

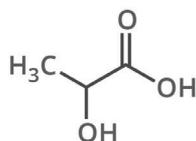
### TOOTH DECAY



BACTERIA



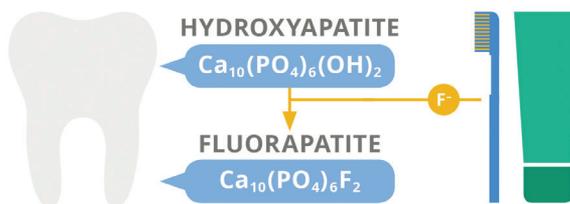
PROPANOIC ACID



LACTIC ACID

Bacteria in your mouth form plaque on your teeth and gums. As they feed, they create organic acids (shown above) from sugars. These attack tooth enamel and can lead to cavities. Acidic foods and drinks can also cause tooth decay.

### FLUORIDE VERSUS TOOTH DECAY



Toothpastes containing fluoride—often in the form of sodium fluoride or tin(II) fluoride—can help prevent tooth decay. Fluoride ions convert hydroxyapatite in enamel to fluorapatite, which is more resistant to acids.

### FILLINGS AND COMPOSITES

MERCURY

Hg

45-55%

SILVER

Ag

22-32%

TIN

Sn

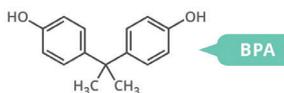
12-30%

COPPER

Cu

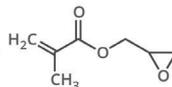
12-24%

DENTAL AMALGAM



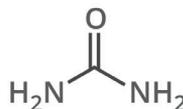
BPA

GMA



Dentists have used amalgam to fill cavities, but it has become less popular because of environmental concerns. Now they use composite resins. The most common is Bis-GMA, formed from bisphenol A (BPA) and glycidyl methacrylate (GMA), which polymerize under ultraviolet light.

### TEETH WHITENING



CARBAMIDE PEROXIDE

A combination of urea (left) and hydrogen peroxide (right)

HO-OH

HO-OH

HYDROGEN PEROXIDE

A solution of 10% carbamide peroxide is roughly equivalent to a 3% hydrogen peroxide solution.

Tooth whiteners can remove surface stains from teeth. Toothpastes whiten with abrasive agents such as silica or alumina. Dentists often use hydrogen peroxide or bleaching agents, such as carbamide peroxide, that break down into hydrogen peroxide.



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