Material other than grapes (MOG), including leaves, stems and insects, that finds its way into the crusher can result in bitterness.

PHOTO: BYMANDESIGNS VIA THINKSTOCK

Bitterness

EXAMINING THE CHEMISTRY BEHIND THE **TASTE SENSATION**

by Deborah Parker Wong

Now with its joyful prime my age is rife,
I quaff enchanting wine, and list to fife;
Chide not at wine for all its bitter taste,
Its bitterness sorts well with human life.

Omar Khayyám

HUMANS ARE PARTICULARLY SENSITIVE TO BITTERNESS. Thanks to a small but novel family of 30 genes, we can perceive thousands of bitter compounds. Our ability to discern bitter tastes evolved as a way to keep our early ancestors from eating poisonous plants.

Bitterness is a **taste** sensation that we experience when monomeric flavonoid phenols, the compounds that are responsible for bitterness in wine, reach the bitter taste receptor cells on our taste buds. As the receptors send electrochemical signals to the gustatory cortex, we experience bitterness. To what degree determines whether we consider a wine to be merely complex, flawed or faulted.

A flawed wine has off aromas and flavors that can be detected and possibly identified, but they don't make the wine unpleasant or undrinkable to the average consumer. Lack of typicity can also count against a wine, but familiarity with the range of varietal expressions possible from different terroirs and winemaking techniques is essential when making that call. Wine is considered faulted when off aromas and flavors suppress or overwhelm the flavor profile and detract noticeably from the quality.

There are a handful of culprits that can be responsible for bitterness as a flaw or fault. Alcohol enhances

PHOTO: VALENGILDA VIA THINKSTOCK

Lady bugs contain enough IBMP that one beetle per vine can taint a tank.

the perception and intensity of bitterness and, as such, wines imbalanced to alcohol can and often do smell and taste bitter. There's a two-fold connection between the higher alcohols, isoamyl and isobutyl, and bitterness. Isoamyl has a burnt, bitter smell, and because they're larger molecules than ethanol, in greater amounts they both contribute to bitter flavors.

Terpenes, the powerfully fragrant molecules that occur in small concentrations in Muscats, Gewürztraminer, Riesling and Torrontés grapes, are often cited as a source of bitterness, but research shows these acid- and enzyme-activated molecules don't contribute to the problem. As a rule, acidity doesn't enhance the perception of bitterness.

Grape seeds are the source of the tannin **epicatechin**, which is significantly bitter and has a long duration of bitterness on the palate. Winemakers take measures to avoid breaking seeds during vinification and typically keep press wine separate to control for bitterness, among other things.

Material other than grapes (MOG), including leaves, stems and insects, that finds its way into the crusher can also result in bitterness, with the biggest culprit being the multicolored Asian lady beetle (lady bug). Lady bug taint is a fault caused by methoxypyrazine, specifically 3-isobutyl-2-methoxypyrazine (IBMP), which we can detect at 10 to 15 parts per trillion. Lady bugs contain enough IBMP that one beetle per vine can taint a tank.

Amertume, the French word for bitterness, is a less common wine flaw or fault that can occur in wines with high levels of anthocyanins. It results from the combination of lactic acid bacteria like *Oenococcus oeni*, *Lactobacillus* and *Pediococcus*, which are responsible for malolactic fermentation and the breakdown of glycerol as it reacts with anthocyanins and other phenols during aging. A wine that tasted sound when bottled could evolve towards bitterness in the bottle, but modern winemaking practices make this fault a rarity.

In the glass, bitterness is often confused with astringency, and differentiating the two takes practice. It's useful to know that we use two different sensory systems to perceive them. But, when it comes to bitterness, we're not all wired the same way. Geneticists have determined that there's an inherited aspect that influences how we taste for bitterness.

Depending upon the shape of our taste receptors, different people tasting the same wine could experience it as intensely bitter, somewhat bitter or without a bitter taste at all. More than 550 bitter-tasting compounds have been identified, of which about 100 have been matched to one or more specific taste receptors. On average, about 75 percent of people can register bitterness and 25 percent are non-tasters who are not able to detect bitterness. In a scenario like a wine competition, a panel would be hard pressed to generously award a wine if several tasters found it flawed or faulted with bitterness, as three-quarters of all consumers would do the same.

Odorless and nearly flavorless, anthocyanins, the water-soluble pigments that color wine red, blue or purple depending upon their pH, impart a mild astringency in wine, while tannins are a source of both astringency and, to a lesser degree, bitterness. Wine can contain two kinds of tannins: **condensed tannins**, a mixture of long-chain (polymerized) phenols called **catechins** found in the skins and stems which are astringent and the bitter grape seed tannin epicatechin; and **wood tannins**, water-soluble, non-flavonoid ellagitannins from oak which are more bitter than astringent.

Astringency is a **tactile**, drying sensation that we feel when grape tannins and wood tannins interact with the glycoprotein in saliva. When wine hits the mechanoreceptors of the trigeminal nerves that detect chemosensory irritation in the mouth and throat signals are sent to the somatosensory cortex. We feel astringency in the tannins found in wine and tea, tobacco and cruciferous vegetables. We also process the feel of viscosity from alcohol and glycerol in the same way. SJ