



# Nanoscience and the Chocolate Experience

## THE SNAP

Cocoa butter polymorphs

Chocolate bars can go from having a distinctive, hard snap to being melty and bendable because of polymorphism—the ability of a chemical to arrange itself in different crystalline forms. Cocoa butter is made primarily of triglycerides, which stack together in one of six polymorphs in response to changing temperatures.

The polymorphs affect the texture, flavor, and melting point of chocolate. Polymorph V, produced by cooling melted chocolate slowly at room temperature, gives you the sharp snap associated with the finest chocolate.

## THE FEEL

Cocoa microparticles and nanoparticles

Cocoa microparticles and nanoparticles, made of fibers, carbohydrates, and proteins, create the smooth, silky mouthfeel.

**Grittier texture:** Microparticles ( $>30\ \mu\text{m}$ )

**Smoother feel:** Microparticles ( $<20\ \mu\text{m}$ ) and nanoparticles ( $<0.1\ \mu\text{m}$ )

Researchers have found that replacing some of the cocoa butter with pockets of air  $< 100\ \mu\text{m}$  increases the total surface area of aggregates of microparticles and nanoparticles. The result is a new structure of stabilized air bubbles interconnected in a fat crystal network that reduces fat and calories while maintaining the mouthfeel.

## Aeration

**Oleogel:** cocoa butter crystals dispersed in oil

**Oleof foam:** air bubbles stabilized by crystals

Source: <https://pubs.acs.org/doi/10.1021/acs.cgd.0c01361>

## THE LOOK

Iridescent chocolate

The same science that gives the bright blue of morpho butterflies and the pearlescent sheen of opals can transform the dull brown color of chocolate into an iridescent sheen without affecting the taste! Creating an array of  $2\ \mu\text{m}$  wide grooves on a chocolate surface causes certain wavelengths of visible light to be reflected and amplified through constructive interference. The result is a shimmery structural color.

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