

# Why menthol chills your mouth when it's not actually cold

January 22 2015, by Anwesha Ghosh

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Two cool. Credit: Africa Studio

Try putting an ice-cube in your mouth. The insides of your mouth and tongue instantly turn numb. Hold it in still and you will feel pain. Now try sucking on peppermint. The mint itself is at room temperature, but your mouth instantly feels cold and numb. How did it do that? The answer is menthol, the ingredient that instantly tricks your brain into sensing that the food is cold.

Nerves are the wiring of the brain, carrying information in the form of electric currents. Our nervous system is built to sense changes in temperatures – a whole set of nerves running from our skin to the brain

is dedicated to conveying just that information. The receptor protein that senses the change in [temperature](#) is called [TRPM8](#) and it is found in all cold-sensing [nerve](#) cells.

TRPM8 is a voltage gated ion-channel protein – meaning it allows entry of calcium ions on sensing change in temperature. We don't exactly understand how TRPM8 does it. Whenever there is a drop in temperature, the voltage on TRPM8 somehow changes and its shape changes so that it allows [calcium ions](#) to flow into the nerve cell. This triggers current to flow from the membrane of the nerve cell. This current carrying vital information warns the brain of the temperature fall.

Falling temperatures is not the only factor that switches on TRPM8, though. A waxy crystalline organic chemical, called [menthol](#), found in peppermint and other mint oils, can somehow bind to TRPM8 directly and activate it. In fact, TRPM8 was first discovered as a protein that responds to menthol and later acknowledged for its role in sensing temperature fall.

We have also found other "cooling chemicals" in nature like eucalyptol and icilin, that act similarly. Peppermint drops fire up TRPM8 in cold-sensing nerves and make your mouth instantly feel cool. Even after you have swallowed, some menthol remains and keeps the nerves activated. Just a sip of water can get the nerves fired up again.

In fact, our nerves have similar proteins to sense hot temperatures as well. Scientists have discovered a protein called [TRP-V1](#) that acts like TRPM8 to sense a rise in temperature. Capsaicin, the chemical that gives hot peppers their zing, directly activates TRP-V1, giving that intense feeling of heat.

## **Kill that pain with cold**

Menthol, eucalyptus oil and other cooling agents have long been used to relieve arthritic and other muscle and bone pain. We still don't understand exactly how it works, but one way it may act is by [activating its receptor](#), TRPM8. Just like your [mouth](#) feels numb when you eat peppermint, applying menthol on your skin activates the cold-sensing nerves making the area go numb. Now you no longer feel the pain. Menthol can also bind to another receptor called [kappa opioid receptor](#) that can also produce a numbing effect.

Rubbing menthol on aching muscles also causes the nearby blood vessels to widen, increasing blood flow in the area. This is called [vasodilation](#). Blood carries in fresh nutrients to repair the area and carries away any toxic waste generated. Healing happens a lot faster because of this.

Lastly menthol takes away the bad effects of [inflammation](#). The word "inflammation" comes from the Latin word *inflammare* which means to ignite or be on fire and came to mean this because of its association with the way an injury causes inflammation and a sensation of heat.

Menthol gives a sensation of cooling by activating TRPM8 without any actual fall in temperature in that area. This brings down the inflammation in the area. Of course that is why cooling the injury with ice works as well.

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