



# Monell Chemical Senses Center

*Press Release*

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## Sweet 'water taste' paradoxically predicts sweet taste inhibitors *Findings provide insight into ways to manipulate human sweet taste*

Philadelphia (April 24, 2006) – A scientific paradox linking artificial sweeteners such as saccharin with a sensory experience in which plain water takes on a sweet taste has guided researchers to an increased understanding of how humans detect sweet taste.

Reporting in an advance online publication in the journal *Nature*, scientists from the Monell Chemical Senses Center describe how certain artificial sweeteners, including sodium saccharin and acesulfame-K, paradoxically inhibit sweet taste at high concentrations. The researchers further report that taste perception switches back to sweetness when these high concentrations are rinsed from the mouth with water, resulting in the aftertaste experience known as sweet 'water taste.'

The *Nature* article describes the phenomenon of sweet 'water taste' and then goes on to explain it at the level of the sweet taste receptor.

"These findings will open doors for tweaking the sweet taste receptor and finding new sweeteners and inhibitors that can be used both by food industry and in medicine," states senior author Paul A.S. Breslin, PhD, a Monell geneticist.

Lead author Veronica Galindo-Cuspinera, PhD, noted while working on a separate study that saccharin – commonly used at low concentrations as an artificial sweetener – loses its initially sweet taste when tasted at high concentrations. Galindo-Cuspinera subsequently observed that strong sweetness returned when the high concentrations of saccharin were rinsed from the mouth with water.

Working with Breslin, she next discovered that high concentrations of saccharin inhibit the sweetness of any other sweetener tasted at the same time.

Testing a variety of compounds, the researchers found that any sweetener that elicits sweet 'water taste' also acts as a sweet taste inhibitor.

To understand how sweet 'water taste' compounds could act both as a sweetener and as a sweet inhibitor, collaborators Marcel Winnig, Bernd Bufe, and Wolfgang Meyerhof of the German Institute of Human Nutrition conducted a series of molecular studies using cultured cells expressing the human sweet taste receptor.

Findings revealed that the cellular responses directly parallel the human perceptual responses.

At lower concentrations, sweeteners activate the sweet taste receptor by attaching to a high affinity binding site, leading to perception of sweetness. However, high concentrations of saccharin and acesulfame-K inhibit the cellular responses to other sweeteners by binding to a second, low-affinity inhibitory site that causes the receptor to shift from an activated to an inhibitory state. When a water rinse removes sweet taste inhibitors from the inhibitory site, the sweet receptor is re-activated and the perception of sweetness returns.

"The phenomenon of sweet water taste is the direct result of releasing the receptor from inhibition," explains Galindo-Cuspinera. "It is rare to find so complete a molecular explanation for a complex perceptual phenomenon. We can now use sweet water taste as a predictor for potential sweet inhibitors."

Sweet inhibitors are used by the food industry to counteract the undesirable high sweetness that results from replacing fats with sweet carbohydrates in reduced-fat products such as snack foods and salad dressings.

"The extremely close parallels between the behavior of the human sweet taste receptor and the perceptual phenomenon are remarkable," comments Breslin. "This two-site model should enable a more complete understanding of human sweet taste perception, leading directly to studies of how to stimulate, manipulate, enhance, inhibit, and create synergy of sweet taste."

The results will be presented at the 28<sup>th</sup> annual Meeting of the Association for Chemoreception Sciences, to be held April 26-30 in Sarasota, Florida.

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The Monell Chemical Senses Center is an independent nonprofit basic research institute based in Philadelphia, Pennsylvania. For 35 years, Monell has been the nation's leading research center focused on understanding the senses of smell, taste and chemical irritation: how they function and affect lives from before birth

through old age. Using a multidisciplinary approach, scientists collaborate in the areas of: sensation and perception, neuroscience and molecular biology, environmental and occupational health, nutrition and appetite, health and well being, and chemical ecology and communication. For more information about Monell, please visit [www.monell.org](http://www.monell.org).

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