

“The Agony and Ecstasy of Capsaicin” Transcript

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MARCO TIZZANO	A lot of people enjoy stuff that is painful. So I was one of these persons that say, oh, I eat always chili pepper. I can eat more and more and get accustomed to that. And get to the next step, and get always hotter chili. In reality, it's not so simple. Most of the time, you're, it's hot. And then you take another one and say, it will be less. And it's is even more. It's not that more you eat, less you perceive that.
LUKE GROSKIN	Marco Tizzano was an investigator at the Monell Chemical Senses Center, whose interest in the science of spicy didn't begin in a lab.
TIZZANO	Nights and weekends, I was working as a chef. And I was fascinated by the idea of the other type of perception, of sensory perception, how they work. And that is how I started my adventure in science.
GROSKIN	And while Dr. Tizzano can cook many delicious dishes, his research has little to do with taste and smell. Instead, his focus is on chemesthesis.
TIZZANO	Chemesthesis is practically the science, the study, the perception of the pain transmitted by the trigeminal nerve.
GROSKIN	Which branches out from a central ganglion in your head down throughout your nose, mouth, and eyes.
TIZZANO	And so all these processes will just transmit the sensation from this periphery part to the central ganglion, and give you a sensation pain, or cold, or warm, depending on what you are using as stimuli.
GROSKIN	In the case of chili peppers, that stimuli is a molecule known as capsaicin, which causes a burning sensation, amongst other maladies. How does one molecule achieve such a lasting effect?
TIZZANO	Capsaicin is a molecule that will bind specifically to a class of receptor that are called TRPV. And they are in mucosas like the mouth, the nose, the eyes. So imagine capsaicin like a key, and the receptor TRPV like a door. When the capsaicin would bind to the door, will open the receptor. And the receptor will allow ion to run through it. This change of potential would be transmitted through the nerve to the center of the system, to the brain. And that is where you get the pain sensation of the heat.

	But then locally, there is this release of a neurotransmitter that is called Substance P and CGRP. And those are the one that would cause you the swelling, the pain, and other sensations. But then there is also fibers in the nose. You will activate there a local inflammation. And that is why you have a runny nose or sneezing. And because the same nerve is also stimulating the eyes, then you will have your watering eyes.
GROSKIN	And because the whole reaction is meant to protect you from what your body has deemed unhealthy, there are a few methods to stop the process. You can't drink water because--
TIZZANO	The sensation will come back again because capsaicin is still stuck on the receptor. Another way is to drink something that contains fat like milk, or something that contain alcohol like beer, because the alcohol and fat in the milk will actually move that from the receptor.
GROSKIN	So what if you expose the system over and over again. Can you actually desensitize it?
TIZZANO	There is all these studies that demonstrate that very short presentation of a capsaicin molecule in very short time frames will cause you to sensitize the receptor. Perception of that would be stronger and stronger and stronger until you stop because you cannot bear that anymore.
GROSKIN	The pain does diminish eventually, but that's not because you gained a tolerance to the chemical.
TIZZANO	What that means is that the receptor will not desensitize, but it will internalize inside the membrane of the fibers because you want to protect the nerve from getting damaged.
GROSKIN	If the pain does seem to go away in the long term, you might actually be damaging your nerves.
TIZZANO	If there is somebody more sensitive to that, may damage that system. And also, sometimes you cannot come back from that and you will lose that system.
GROSKIN	And if all this doesn't convince you that you can't just build tolerance to spicy food, just remember, it's all in your head anyway.

TIZZANO	<p>There are several studies that demonstrate that if you eat hot pepper or if you're a person that don't eat hot pepper and you provide them different concentration of chili pepper, both of them will describe with no statistical difference that these chili pepper were unbearable, or mild, or very bland. And that is because the people that eat the hot pepper still perceive that as a pain, but they enjoy it. They eat that and say, oh, I can do that. But it's just because you want to do that. But it's very painful anyway.</p>
GROSKIN	<p>For Science Friday, I'm Luke Groskin.</p>