Medical Xpress

Tears reveal some of their deepest secrets to researchers

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It's no secret why we shed tears. But exactly what our tears are made of has remained a mystery to scientists.

A new study sheds some light on the complex design of tears. What we think of as tears, scientists call tear film, which is made up of three distinct, microscopic layers. The middle, watery layer – what we normally think of as tears when we cry – is sandwiched between a layer of mucus and an outer layer of fatty, oily substances collectively called meibum.

It's in this outer layer that researchers describe, for the first time, a new class of lipids – a type of fat – that make up part of the film. They also identified one of these lipids, oleamide, which had not been known to be a part of tears before.

With each blink, meibum spreads over the surface of the eye. It keeps the watery middle layer in place, ensuring that our eyes stay moist.

Finding these lipids may help scientists better understand the causes of eye-related disorders such as dry eye disease, which affects anywhere from 12 to 14 million Americans, said Kelly Nichols, the study's lead author and an assistant professor of optometry at Ohio State University.

"The lack of certain compounds in the tear film may result in a number of different eye-related disorders, including dry eye," she said. "The amount of oleamide and related lipids in tear film may be related to

these disorders."

Dry eye is really a collection of irritating symptoms that includes microscopic damage to the front of the eye. The eyes may ache, burn, feel extremely dry or excessively tear.

The researchers report their findings in the current issue of the journal *Investigative Ophthalmology and Visual Science*.

They collected oily meibum secretions from the meibomian glands of healthy volunteers. The meibomian glands are tiny, grape-like clusters of cells that line the rim of our upper and lower eyelids – the outlets to these glands are roughly adjacent to the eyelashes. Researchers gently pressed the volunteers' lower eyelids and collected droplets of meibum in tiny glass tubes.

The researchers examined the meibum samples in the laboratory. They used a technique called electrospray mass spectrometry to differentiate between the different lipid components. This technique adds an electric charge to microscopic droplets of the oily substance, which allows the instrument to detect different components based on electrical charges and mass.

Nichols points out that researchers have used other techniques, such as chromatography, to characterize types of lipids in the tear film, but advances in mass spectrometry technology are improving research efforts.

"Other scientists used different techniques to try to determine the composition of meibum, but mass spectrometry is sensitive enough to detect individual lipid molecules, like oleamide," Nichols said.

Oleamide was first identified as a lipid in the brain, where one of its

roles is to induce sleep. It also has other key functions throughout the central nervous system. But the current study is the first to find and describe oleamide and related lipids in tear film.

"The finding could give us more insight into the role of lipid activity in humans and may also indicate a new function for oleamide and related lipids in cellular signaling in the eye and in the maintenance of tear film," said Nichols, adding that researchers don't fully understand the function of oleamide, or the other lipids in the meibum.

"Oleamide appears to be a predominate lipid in tear film," she said. "It's there for a reason, but we're not sure yet what that reason is."

Nichols and her team are currently studying the role of oleamide in cellular signaling and communication in the eye, along with the role that the lipid may play in dry eye.

"Dry eye is really a disorder of symptoms that irritate the eyes," Nichols said. "Not everyone with dry eye responds to the same treatment. If we could find individuals with varying oleamide levels, then we may be able discern one cause of dry eye, and specifically treat that.

"Even though two people with dry eye may have the same symptoms, there may be very different causes underlying those symptoms."

Source: Ohio State University